ENVIRONMENTAL SHOCKS, HETEROGENEOUS VULNERABILITY, AND WITHIN-COMMUNITY INEQUALITY: EVIDENCE FROM RURAL ETHIOPIA

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This study examines the relationship between rainfall deficits and social and economic inequality within rural Ethiopian communities. The first set of analyses focuses on the case of a single rainfall deficit-affected community in rural southern Ethiopia, drawing upon data from qualitative interviews, focus groups, and a household survey. Results show that livestock inequality decreased at a greater rate during the drought-affected years than a preceding year with average rainfall. Non-livestock asset dynamics appeared largely disconnected from drought. These results are in part supported by a statistical analysis of the association between rainfall deficits and wealth inequality within rural communities across three regions of Ethiopia. This set of analyses draws upon the Ethiopian Demographic and Health Surveys and an agro-climatology dataset from the National Aeronautics and Space Administration. Results show that rainfall deficits were associated with decreased livestock inequality in the region of Tigray, but non-significant changes in Amhara and Oromiya. The association between drought and non-livestock assets was non-significant. The case study also considered the effect of rainfall shocks on other forms of inequality. Results suggest that the equalizing effect of drought on livestock ownership corresponded with growing inequalities in other outcomes. Households that sold livestock often did so from of a position of relative power within the community. Many of these households were able to use the proceeds of livestock sales to maintain food consumption and assist other

households. Such assistance was often paid back in cash or labor, and implicitly increased the benefactor's access to the beneficiary's labor in the future. In contrast, less wealthy households often responded to drought-related food insecurity by engaging in wage labor, and borrowing food or money. The receipt of resources during periods of environmental stress often improved access to essential food, but came with expectations of repayment or obligations to provide future labor. These relationships and obligations may constitute sources of cumulative (dis)advantage over the long run. It may be productive to move away from a purely social determinants perspective on vulnerability to environmental change, and instead consider how social inequality and environmental shocks interact in a cyclical manner over time.

BIOGRAPHICAL SKETCH

Brian C. Thiede graduated with a BA (honors) in International Relations from Bucknell University in 2008. In 2010, he earned an MS from Cornell University in the field of Development Sociology, in which his Ph.D. research was also conducted.

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CHAPTER 1: INTRODUCTION

Introduction

Research on the social impacts of environmental dynamics has proliferated as evidence of global climate change mounts (Adamo and Izazola 2010, Adger 1999, Black et al. 2011, Dunlap 2010, Shove 2010, Yearly 2009). A growing body of evidence shows that both short and long term environmental changes affect a number of social and economic outcomes among affected populations. This is particularly (but not exclusively) true in rural parts of the so-called developing world where livelihoods are often closely linked to environmental conditions. Environment-affected outcomes include consumption, food intake, and spatial mobility or migration (Dercon et al. 2005, Hoddinott 2006, Gray and Mueller 2012a, Gray and Bilsborrow 2013, Thiede and Brown 2013). In some cases, the effect of environmental changes on the likelihood of these outcomes has been shown to vary among different types of households, which reflects heterogeneous vulnerability.

However, the majority existing research has focused less on differences within populations than on the broader question of whether the environment affects these outcomes at all. That is, it has focused on identifying average statistical associations between environmental change and the outcomes described above, with relatively little attention to potential heterogeneous effects and explanatory mechanisms. Further, research that has examined between-household or -person differences provides limited insight into how micro-level heterogeneity contributes to aggregate changes in the social structure of affected communities. Given the implications of such inequality for a number of important outcomes—including community cohesion and the future opportunity sets of affected households—research on the link between environmental shocks, heterogeneous vulnerability, and social and economic inequality

is merited (Adger 2000, Neckerman and Torche 2007, Tierney 2006). This dissertation contributes to knowledge on this topic by examining the effect of rainfall deficits on multiple dimensions of social and economic inequality within rural communities in Ethiopia. This research is motivated by an interest in understanding how the impacts of, and responses to rainfall deficits—and subsequent changes in crop production and related economic conditions—affect the distribution of wealth and economic opportunities within agrarian communities.

This motivation stems from a concern that previous social science research on the environment has placed disproportionate emphasis on the social construction of disasters, hazards, and environmental change relative to the potentially important independent effect of environmental changes on social processes (Cutter et al. 2003, Klinenberg 1999, Pais et al. 2013, Wisner et al. 2004). Without disputing that many dimensions of vulnerability are socially constructed, I consider how—given an uneven social landscape within communities—environmental changes may have significant and persistent effects on social and economic inequality within communities. In light of expectations that the frequency and/or severity of weather shocks will increase as a result of global climate change, research on this topic will become increasingly useful for academics and practitioners interested in social and economic development (Karfakis et al. 2012).

This manuscript proceeds as follows. In the remainder of this first chapter, I review existing literature on social vulnerability, household coping strategies, and the social and economic impacts of environmental shocks. I demonstrate that little is known about the potential effects of environmental shocks on social and economic inequality in affected communities. I also outline why this is a theoretically and practically compelling topic for research. In the second through fifth chapters, I present an in-depth, mixed-methods case study of a rainfall

deficit-affected community in rural southern Ethiopia. This case study explores how rainfall shocks affected asset and livestock inequality, as well as households' access to other resources and opportunities. In the sixth chapter, I assess whether the case study's findings about the relationships between rainfall deficits and within-community asset and livestock inequality, respectively, are generalizable to communities in other parts of Ethiopia. Specifically, this chapter analyzes the statistical relationship between rainfall deficits and within-community asset and livestock inequality in rural areas of three regions: Amhara, Oromiya, and Tigray. The seventh and final analytical chapter compares and synthesizes the findings from the case study and chapter six, and outlines directions for future research.

Previous research

One of the fundamental insights of environmental sociology is that seemingly natural events are often shaped by existing social conditions (Catton and Dunlap 1978). The effects of what appear to be natural disasters are jointly determined by the magnitude of the event and social processes that affect vulnerability to it—that is, a given household's exposure, sensitivity, and capacity to resist and recover from shocks or stresses (Bohle et al. 1994, Chambers 2006, McLaughlin and Dietz 2008, Watts and Bohle 1993, Watts 2013).[1] Social processes affect vulnerability through a number of channels, including by influencing the level and distribution of resources, constraining response strategies, and shaping baseline environmental conditions through historical patterns of development and natural resource use. Vulnerability is a useful concept for thinking about potential heterogeneity in the impact of environmental shocks because it draws attention to the multiple components of impact and response—exposure, sensitivity,

[1] This discussion focuses on households, but many of the insights outlined here are also relevant to other social or spatial units.

response, and recovery—as well as the historicity of social and ecological conditions that shape these factors.

While not necessarily employing the concept of vulnerability explicitly, previous research on famines, natural disasters, and other events related to environmental change has demonstrated that responses to, and impacts of these events are often stratified along the lines of pre-existing social inequalities and ecological differences (e.g., elevation, soil quality). Given systematic heterogeneity in vulnerability, one would expect environmental shocks to have significant, and persistent or path dependent effects on inequality between households in affected areas. Existing research provides hypothesis-generating insights about the potential relationship between shocks and inequality, but studies of this topic to date are limited in number and hampered by significant conceptual and methodological limitations. In the pages below, I review this previous literature to demonstrate this knowledge gap and develop a set of hypotheses about the effect of environmental shocks on social and economic inequality within affected communities.

Environment, society, and vulnerability

Environmental sociologists have spilled considerable ink debating the theoretical distinction (or lack thereof) between 'nature' and 'society'. These perspectives range from materialist and constructivist dismissals of the independence or importance of the natural environment vis-à-vis social processes and cultural schema, to arguments that society is inextricably linked to environmental processes and societies' particular understandings of what constitutes nature (Bryant 1992, Cronon 1991, Dunlap and Marshall 2007, Goldman and Shurman 2000, McLaughlin and Dietz 2008, Woodgate and Redclift 1998). These views reflect

both the particular epistemologies of the authors and their substantive foci (e.g., environmental dimensions of development, environmental science/knowledge).

The theoretical orientation of research on environmental shocks and disasters generally falls between the ideal types of social and environmental determinism. With few exceptions, scholars consider these shocks to be exogenous to the societies they affect, but also argue that the particular impact and outcomes of a given shock are contingent upon a number of socially conditioned factors. This approach draws attention to ways in which environmental shocks interact with social inequalities and ecological conditions shaped by historical social processes (Campanella 2008, Scoones 1997). As Morrow puts it,

> The impact of a natural event on any given community… is not random, but determined by everyday patterns of social interaction and organization, particularly the resulting paradigms which determine access to resources (Morrow 1999: 2).

This theoretical perspective does not negate the reality and importance of the natural environment, but rather is careful to identify potential mediating social factors that shape outcomes during these events.

The concept of vulnerability provides a useful lens for identifying the factors and underlying historical processes that uniquely structure nature-society interactions across space and time. Chambers (2006) defines vulnerability succinctly, as the product of a household's exposure to a given shock and ability to cope during and after that event without experiencing damaging losses. Potential losses include impoverishment, social dependency, and stigmatization.[2] In some cases—as Watts and Bohle (1993) demonstrate—vulnerability may be endogenous to some crisis-prone social systems, but this concept can also inform expectations about the impacts of exogenous crises, including those brought about by environmental change.

[2] This concept is not limited to household-level phenomena – one could think of vulnerability at the sub-household (i.e., individual) level, as well as with respect to communities, regions, and other spatial units.

As defined above, vulnerability to shocks can be thought of as the net outcome of a four-variable sequence: (1) exposure, (2) sensitivity or impact, (3) response, and (4) recovery.[3] The work of Bohle et al. (1994), Chambers (2006), and Watts and Bohle (1993) identifies three key conjunctures of factors that determine a given household's level of each variable. The first encompasses factors at the immediate intersection of environmental and social conditions, including the magnitude of the shock, local and regional ecological conditions, and the degree to which livelihoods depend on resources affected by the shock. The second dimension includes social and economic entitlements. These represent a household's assets and ability to acquire goods and services through the market, social relations, and by making claims on public and private institutions (Sen 1976, Devereux 2001). These social and economic resources may be subject to threshold effects, whereby households fall to such a level of asset poverty or dispossession that their chances of adequate response or recovery are significantly diminished (Carter and Barrett 2006, De Waal 2005). Third, macro-structural tendencies, such as secular processes of surplus value extraction (i.e., exploitation) and cumulative advantage and disadvantage among different social groups, may shape the distribution of exposure and social, economic, and natural resources. These structural processes may also constitute an endogenous source of crisis, particularly over broad spatial scales and temporal periods.

Of course in practice, the above components of vulnerability are inextricably linked. For instance, socially driven processes of resource extraction and/or management in part determine the state of natural resources in a given area (Leach et al. 1999). Likewise, macro-structural processes may affect a household's endowment of social and economic resources by shaping the availability of opportunities to increase resources (e.g., income generating activities), as well as

[3] These variables are, of course, inter-dependent, and a given household's level of these variables may vary according to the type of environmental shock in consideration.

its ability to use those resources to reduce exposure, respond to, or recover from shocks (e.g., market conditions). Given the relationship between these three conjunctures of factors, Bohle and Watts (1993) conceptualize them as three inter-connected axes defining a "space of vulnerability".

Most of the scholars cited above work within a materialist political economy—or political ecology—tradition, and therefore tend to present vulnerability in objectivist, structural terms. However, socially conditioned perceptions of environmental shocks and related risk may also have important implications for vulnerability (Mertz et al. 2009, Tschakert 2007). Risk perceptions may influence pre-shock household decisions and behaviors that affect vulnerability (e.g., place of residence, savings). Indeed, subjective understandings of risk are perhaps the main determinant of behavioral responses to risk (Smith et al. 2000). For example, there is considerable evidence that poor households engage in risk-reducing livelihood diversification strategies across the developing world (Ellis 1998). However, these behaviors may be contingent upon perceptions about the level and nature of risk, as well as the likelihood that a particular set of behaviors may effectively reduce that risk. Further, a household's response to a given shock is conditional upon its perceptions of the existence and magnitude of that risk (Gray and Mueller 2012a). The threshold at which a rainfall deficit is considered a drought, for example, may vary among social groups, with subsequent implications for the responses to, and consequences of that deficit (e.g., one group may alter crop patterns appropriately). Such heterogeneous perceptions have been well documented in studies of risks faced by East African pastoralists (Doss et al. 2008, Smith et al. 2000).

These materialist and constructivist insights are not mutually exclusive, of course; perceptions are often grounded in objective conditions. Considered together, these approaches

provide a broad framework for conceptualizing households' vulnerability to environmental shocks, and assessing why vulnerability may vary among households. In this framework, vulnerability is a function of a household's exposure, capacity to respond and cope, and ability to recover. Exposure is determined by the nature and magnitude of a given environmental shock, the ecological conditions in which the household is embedded, and the household's productive activities, which are affected by social and material constraints and risk perceptions. A household's assets, ability to acquire goods and services through social, economic, and political channels, and perceptions of a given shock determine coping and response capacities and choices. Recovery is affected by these factors as well, but may also be contingent upon the severity of the shock's social, economic, and ecological impacts.

Combined, these factors shape the net impact of a given environmental shock on a household's social and economic status. Differences in these factors among households will therefore shape the effect of environmental shocks on inequality between households. Environment-related change in inequality within communities is a function of differential vulnerability among resident households.[4] In the absence of systematically distributed differences in vulnerability, environmental shocks will affect only the mean of a given outcome (e.g., wealth) with no distributional effects among households.[5] However, in the likely event that vulnerability differs among households, environmental shocks will produce changes in the distribution of social and economic resources and related outcomes (e.g., food consumption). Despite this logical truism—and evidence that vulnerability often varies among households—existing research has given limited attention to the distributional impacts of environmental shocks at the community- or other macro-levels.

[4]It is also theoretically possible that heterogeneous impacts among households will perfectly offset and between-household inequality not change.
[5] Assuming inequality is estimated using a scale-invariant measure.

The distributional effects of environmental shocks

Few published studies to date have examined the effect of environmental shocks on between-household inequality. Those that have consider between-household inequality across relatively large spatial scales that are often socially and ecologically heterogeneous, and remote from where most social and economic interactions take place. Evidence about the distributional effects of shocks within communities is non-existent. Addressing this question at the community level is particularly important because community members are often connected through social and economic relationships, and relative deprivation within communities may matter more than across larger populations (Massey 1988). Reviewing existing evidence about the distributional effect of environmental shocks is nonetheless helpful for developing hypotheses and highlighting a number of methodological challenges that research on this topic must address.

Reardon and Taylor (1996) examine the relationship between an "agroclimatic shock" (i.e., drought) and income inequality in Burkina Faso. This study compares the distribution of household income within three agroclimatic zones that were differentially exposed to drought. The authors compare the most and least affected zones to draw inferences about the effect of this shock. Results show that income inequality decreased slightly in the most-affected zone and remained constant in the least-affected area, which suggests that drought may have had an equalizing effect with respect to income. A decomposition analysis shows that income equalization in the most drought-affected zone was due largely to increased livestock-related income among the poor, which likely reflects food insecurity-induced distress sales. Crop income had an equalizing effect in this zone; but income from seasonal migration increased in importance between the pre- and post-drought observations. Earnings from seasonal migration

were disproportionately realized by relatively wealthy households, and thereby placed upward pressure on income inequality.

This study demonstrates the importance of considering the underlying processes that underlie the link between environmental shocks and changes in inequality. In this case, increased livestock income among the poor may reflect drought-related food insecurity, which motivated distress sales of livestock. The resulting short-term increase in income among the poor may have come at the expense of those households' long-term economic status, as embodied in livestock. As such, the observed equalization of income within the drought-affected agro-ecological zone may obfuscate growing disparities in wellbeing, and perhaps resilience to future shocks. In a theme that will emerge throughout the current study, this marks a potential 'dark side' to some instances of equality or equalization.

Reardon and Taylor's study may also serve as a reminder that income is a potentially problematic indicator of wellbeing, particularly in developing country contexts where the use and value of official currency often varies within and among communities and regions. Currency and income are also often subject to short-term volatility and reporting error, which has motivated a shift toward consumption- and asset-based indicators of poverty since Reardon and Taylor's paper was published (Coudoul et al. 2002). Their study has a number of other methodological limitations as well. For example, Reardon and Taylor draw upon a very small and geographically limited sample to make inferences about relatively large agro-ecological zones: 25 households from two villages, per zone. These zones are unlikely to represent meaningful spaces of social interaction between households. Further, environmental conditions likely varied markedly within these zones. It is therefore difficult to claim that an entire zone experienced a certain set of environmental conditions, much less draw inferences about the effect

of those conditions using observations from only two sites in that zone. Additionally, the authors do not control for other factors that may have affected inequality within the study areas. Finally, Reardon and Taylor focus solely on observed changes in particular income sources, thereby neglecting to examine potentially processes of income stratification between social or economic groups.

To date, only two other published studies have examined the relationship between environmental change and inequality. Valentine (1993) estimates differences in income inequality across rural Botswana between years with optimal weather conditions and years of severe drought. Minimal differences were observed, but there were notable shifts in the average composition of household income. Borrowing, wage labor, and transfers were more important during the drought than in years with normal conditions. Interestingly, many of these changes likely involved the utilization of preexisting social networks or the development of new, sometimes exploitative social relationships. These observations underline the ways in which non-economic resources shape household coping strategies, as well as how particular strategies may have significant long-term consequences. However, neither of these implications was explored in the paper.

Valentine's paper is also methodologically limited. First, there was no effort to isolate the effect of drought from other potentially confounding changes. Second, Valentine did not analyze the underlying sources of changing inequality, despite evidence of important shifts in income composition and distribution between households. Finally, income was calculated using different methodologies in the first and second waves of survey data. The degree to which the observed changes were due to this methodological change, the drought, or other potential confounding factors is not clear.

In the final published study on this topic, Fratkin and Roth (1990) explore drought-related stratification with respect to livestock ownership among Ariaal pastoralists in northern Kenya. This is a compelling site for this study since livestock are the primary source of economic wealth and social prestige for these pastoralists. Overall, the authors find evidence of increased wealth differentials in the aftermath of drought, but these findings are nuanced. Pastoralists ranked as rich before the drought suffered the largest pre- to post-drought changes, but nearly half remained rich and none fell into poverty according to their typology. The pre-drought rich were more likely to maintain stocks of large animals, which hold greater prestige and economic value than small stock. In contrast, more than two-thirds of those ranked in the middle wealth category fell into poverty, and none in the middle and lower groups experienced upward mobility. Small animals predominated in the herd portfolio of these groups, reflected in lower weighted totals of livestock holdings.

The slightly divergent trajectories of these groups partly reflect differences in species-specific mortality and natural reproduction. These biological processes are important but among social scientists rather understudied factors, which shape the effect of environmental shocks on livestock holdings. Fratkin and Roth also observe that many of the coping mechanisms employed by low-wealth pastoralists led to increased dependency on other community members, and diminished ability to live self-sufficiently in the pastoralist economy (Fratkin and Roth 1990). Examples include herding for other households, entering the cash economy via livestock sales and commodity purchases, and labor migration (i.e., permanent or temporary abandonment of pastoralism). A shift in social relations may therefore underlie changes in asset holdings, although these effects are not fully explored in this paper.

This study also has a number of methodological limitations. For one, it considers only a small number of households (n=38), and is limited to describing changes in livestock holdings before and after the drought. Importantly, it also does not account for potentially confounding factors. As such, the authors' attribution of changing inequality to drought rests on shaky empirical ground.

Collectively, these studies suggest that drought may be associated with income equalization, but increased asset inequality. These studies also identify a number of important processes that underlie aggregate changes in inequality. These include: heterogeneous odds of selling livestock or experiencing livestock mortality; social transfer receipt and other changes in income composition; the use of credit; and the formation of social relationships characterized by future obligations or dependency. These studies also show that relatively wealthy households may be most likely to experience large asset losses during period of environmental stress, which may be function of their high level of exposure (i.e., herd size) and greater ability to sacrifice assets to maintain consumption vis-à-vis the poor. This counters common narratives that suggest the poor are uniformly most-affected by shocks. The results discussed here also emphasize that conclusions about the effect of environmental shocks are contingent upon the precise outcome being examined. What may appear for some to be a normatively good outcome (e.g., equality, increased income) may reflect other forms of disadvantage (e.g., food insecurity) and other processes with long-term negative implications.

Despite these insights, knowledge about the distributional effect of environmental shocks remains limited in at least three key ways. For one, the amount and geographic diversity of evidence is extremely limited. The articles reviewed above are exhaustive of the published literature on this topic to date, making it difficult to draw generalizable conclusions. Second,

existing studies have focused on broad geographic areas that are remote from the spatial units needed to accurately measure environmental conditions, and the places in which most social and economic interactions and exchanges occur. The arguably more important question of how shocks affect inequality within communities—or other socially and economically meaningful places—remains unaddressed to date. The need for finer-grained analyses is particularly relevant in remote rural contexts characterized by isolation and extreme poverty. Social and economic interactions may be particularly geographically limited in these contexts. Third, the existing evidence reviewed above made little progress toward identifying causal relationships. These studies were variously limited by low sample size, weak sampling strategies, and poor control for potentially confounding factors. As such, there is significant room for future research to evaluate the impact of shocks on within-community inequality in a more theoretically and methodologically rigorous manner.

Heterogeneous vulnerability and micro-level outcomes

Given the dearth of research on the distributional impacts of environmental shocks among households, studies of how these events affect micro-level outcomes provide the main source of evidence for formulating expectations about the relationship between environmental shocks and between-household inequality.

Empirical research on vulnerability faces two significant, and related challenges. First, the multiple, temporally sequenced conditions or outcomes that define a household's overall vulnerability (exposure, sensitivity, response, and recovery) make it a difficult concept to operationalize and measure. For a given household, the relationship between these components (say, exposure and response) may be non-linear and subject to threshold effects. These

relationships and effects may vary among households. As a result, it is not possible to draw inferences about overall vulnerability from observations about any single component. Second and relatedly, the multi-phasic nature of how vulnerability is manifest makes pre-shock measurement or estimation difficult. This is not necessarily a challenge to research on vulnerability per se, but a limitation for researchers interested in identifying vulnerable groups without reliable historical analogs.

Despite these challenges, a limited body of research has attempted to develop aggregate measures of vulnerability. Much of this work has focused on place-based vulnerability, and in many cases has utilized factor analysis to construct parsimonious indices of vulnerability (Birkmann 2006, Cutter et al. 2003, Cutter and Finch 2008). Unfortunately, much of the theoretical depth of previous literature on vulnerability has been lost in such analyses, which often predict natural disaster destruction well. (Cutter et al. 2003). However, these place-based models rarely account for other dimensions of vulnerability (i.e., response, recovery) or the often-significant differences in vulnerability within the places they consider.

Literature on the individual and household level responses to, and impacts of environmental shocks is perhaps more useful for generating hypotheses about the distributional effects of environmental shocks. The predominance of research on micro-level outcomes largely reflects the often-correct assumption that the household is the primary decision-making unit with respect to risk management and the allocation of resources. This assumption has its roots at least as early as the 1980s, when the new economics of migration emerged as a popular paradigm (Stark and Bloom 1985), and a broader set of research on household coping strategies developed as scholars attempted to understand the complex causes and consequences of famines (Corbett 1988, De Waal 2005, Sen 1981).

Coping strategies

Research on coping strategies emerged as part of a response to what was seen as overly deterministic and supply-side accounts of food crises. This literature demonstrates that households exercise agency and act strategically vis-à-vis social and economic objectives in contexts of crisis and, in many cases, this behavior varies systematically (e.g., by social strata). Corbett (1988) reviews the first wave of literature on household coping strategies. This research suggests that coping behaviors tend to occur in a predictable sequence. At first, households often utilize social support networks (e.g., informal transfers or borrowing), alter crop patterns, send household members to other locations temporarily, and engage in new, or more income- and food-generating activities away from their own farm. Later, households may sell or rent out key assets (e.g., livestock, tools, land), borrow from often-usurious merchants and moneylenders, and reduce consumption. Finally, households may abandon their homestead in temporary or permanent distress migrations.

A more recent body of work has conceptualized coping strategies as a set of immediate and short-term changes to food consumption patterns, which can arguably be used to identify acutely food insecure households (Maxwell 1996, Maxwell and Caldwell 2008). The so-called Coping Strategies Index (CSI) has been widely utilized by researchers and development practitioners to assess household food insecurity, its distribution across space, social groups, and time, and the impact of programming on these outcomes. Although the CSI draws attention to a narrow set of behaviors (i.e., does not account for changes in production, wealth) its identification of a near-universal set of core responses to food insecurity is consistent with the common strategies identified by Corbett above. I discuss the CSI further in Chapter 4.

Both Corbett and Maxwell acknowledge that the actual timing and set of strategies employed by households is often heterogeneous, with clear implications for households' short- and long-term set of resources. In other words, differential responses reflect and produce differential vulnerability. Corbett argues that the particular set of strategies employed by households will vary according to the precise type of shock that occurs, local market conditions, and *ex ante* household livelihood activities and assets, which can be broadly defined to include social and economic resources. Importantly, traditional livelihood activities are shaped by local social norms, which many households are reluctant to break even during periods of stress (De Waal 2005). These factors variously influence the particular behaviors that a household is, or perceives to be able to engage in. For example, asset-poor households may have to borrow money or reduce food consumption, while wealthier households may utilize savings to purchase food off the market. Moreover, the same response may have radically different implications for different households: the sale of a single livestock will have more consequences for those with smaller herds than larger ones. Similarly, the sale of livestock by sedentary farmers may represent a liquidation of excess savings, but for pastoralists reflect a loss of key productive assets, social status, and meaning.

Roncoli et al. (2001) examine the responses of households and household members to drought in Burkina Faso. Here, they emphasize the tensions and negotiations this entailed, including the trade-offs between short-term needs and long-term food security and wellbeing. They find that the impact of the drought was most severe among poorer households, who were unable to rely upon stores of grain from previous crop surpluses—as many wealthier households had. As a result, lower-ranked households had to use a greater proportion of their income and

liquidate assets to purchase food from the market. These actions eroded their self-sufficiency and subjected them to the pressures of an increasingly tight market.

In the Burkina case, households employed a number of strategies to cope with the drought and subsequent crop failures. These included relying upon transfers from social relations outside of the affected area; sending young men to work elsewhere and children to unaffected relatives' homes; enforcing additional controls on women's management of grain stores; lowering food consumption; and consuming so-called famine foods. The use of these strategies differed across social groups. For example, poorer households were, on average, smaller and therefore less likely to send their members elsewhere; doing so could lead to a labor shortage in the household. Within households, women were considered more financially responsible and given disproportionate control over financial matters during the period of stress, marking an important redistribution of power between men and women in affected areas. In another instance, wealthier households—and traders arriving from other locations—were able to expand their livestock herds by taking advantage of fluctuations in the local cattle market caused by distress sales.

Although Roncoli and colleagues do not discuss the implications of these dynamics for inequality per se, this case shows that environmental crises are not simply moments of dispossession and devaluation. Rather, environmental shocks may also contribute to a context in which certain actors can accumulate wealth and secure advantageous social positions vis-à-vis others (see also Watts 2013). This study also demonstrates that shocks may have random, unpredictable impacts. In this case, many of the relatively poor households controlled lands at relatively low elevations, which had historically been viewed as marginal. During periods of low

rainfall, however, these lands were seen as increasingly desirable due to their relatively high moisture and fertility.

Many households continued to invest in social networks during this period of crisis, spending resources on weddings, funerals, and baptisms despite food insecurity and other resource scarcity. The crisis also affected agricultural practices during the following growing season. An above-average proportion of farmers (33% more than the previous year[6]) had to purchase seeds prior to planting, since many consumed their surplus seeds during the drought. Many farmers also changed the composition of their crops, shifting toward faster-maturing grains (e.g., maize) and away from cash crops due to a lack of capital. Finally, many households reported on-farm labor constraints due to out-migration, under-nutrition, and a lack of resources for hiring wage labor.

Broadly speaking, research on household livelihood strategies in the context of famines and droughts emphasizes the complex and sequential sets of activities that households undertake to meet basic conditions for survival, and protect—or in some cases expand—their productive assets. These activities are constrained by social, economic, and environmental conditions, which differentiate outcomes and may therefore underlie environment-related changes in inequality.

Economic impacts

A number of other studies have examined the impact of environmental change, variously defined, on social, economic, and demographic outcomes at the individual- and household-levels. Much of this research has focused on poverty, nutrition, and other indicators of material wellbeing, as well as out-migration. These studies provide useful insight into the average social

[6] The percentage of farmers who purchased seeds increased from 43% to 76% between 1997 and 1998. In 1998, 62.5% of higher ranking households, and 85% of lower ranking households, purchased seeds (Roncoli et al. 2001: 128).

and economic impacts of environmental change, and somewhat more limited evidence about the social conditions that may exacerbate or mitigate environmental impacts among affected households.

Little et al. (2006) study poverty dynamics associated with drought in northeastern Ethiopia. There, drought had a heterogeneous impact on household assets (livestock), at least in the medium-run. Many households that were livestock-poor prior to the drought maintained or even accumulated (very slightly) assets during and immediately after the drought, often by reducing consumption and engaging in wage labor or petty trade. Any gains that were realized, however, were rarely enough to lift these households out of poverty, or provide a buffer against future shocks. In other words, the poor remained poor and vulnerable to future crises. In contrast, wealthier households experienced large proportional decreases in their livestock stores, but began to recover toward pre-shock assets levels in the months after.[7] Although these households experienced the largest up-front losses associated with the drought, they nonetheless maintained relatively large stores of wealth. As a result, they were positioned to recover and further accumulate livestock over the long run, and thus maintain a degree of resilience against future shocks.[8]

The short-term impacts on livestock had implications for the poor as well, since social transfers (i.e., redistribution) diminished in step with livestock sales among the wealthy. After the drought, Little et al. also note that many wealthier households were able to maintain their economic standing by taking advantage of the favorable livestock market conditions, natural reproduction of their relatively large herds, and forming profitable herd-sharing contracts with

[7] The authors state that interviews indicated that while some livestock died, many more losses were the result of sales.

[8] This stands in contrast to relatively asset-poor, who experienced limited up-front losses but nonetheless remained stuck in a low-asset poverty trap.

the poor. This study demonstrates that the coping and recovery strategies of affected households involved both changes in the distribution of wealth and formation of new types of social relationships.

In another study of Ethiopia, Dercon et al. (2005) use data from the Ethiopian Rural Household Survey (ERHS) to examine the effects of multiple types of shocks (including weather shocks) on household per capita consumption in rural villages. They find that drought was one of the few shocks observed between 1999 and 2004 to have significant effects on consumption (measured in 2004). The evidence suggests that these effects were persistent as well: droughts that occurred between 1999 and 2001 were associated with lower consumption in 2004. These impacts were also differentiated across social groups. In particular, the consumption of female-headed households, households of which the head had no schooling, and households in the lower three quintiles of land size (within each village) were more affected by the drought than those in their respective reference groups. These findings are consistent with research by Hoddinott (2006), who finds that households with low initial levels of assets are more likely to reduce consumption (i.e., smooth assets) than liquidate assets to smooth consumption (see also Barrett and Carter, 2013; Carter and Lybbert, 2012; De Waal, 2005; Hampshire et al., 2009; Zimmerman and Carter, 2003).[9]

Santos and Barrett (2006) examine herd dynamics among Boran pastoralists in Ethiopia, and compare patterns of expected change across different environmental contexts. They find that the relationship between initial and expected herd size is linear during years of normal environmental conditions, but highly non-linear during years of environmental stress. This suggests that herders' self-perceived likelihood of protecting their herds during periods of

[9] Hoddinott also finds that women and children were disproportionately negatively affected—as indicated by anthropometric measures—and that these within-household effects varied according to households' initial economic status.

environmental stress varies, which the authors attribute to herders' ability[10]. Indeed, their data show that the initial and expected herd sizes of low-ability herders tend to converge at a low-level equilibrium, while the expected herd dynamics of high-ability herds exhibit an S-shaped pattern. While both high- and low-ability herders are shown to be prone to falling into asset poverty, the probability of doing so differs between these two groups—and for high-ability herders, odds vary by initial herd size. This has clear implications for inequality, which Santos and Barrett begin to explore via simulation techniques. Results from these simulations show that inequality is likely to increase if the relationships and expected herd dynamics observed in their data are extrapolated over a ten-year period.

Carter et al. (2007) examine household wealth dynamics in the aftermath of a hurricane and drought in Honduras and Ethiopia, respectively. In Honduras, they find that the impact of a hurricane was disproportionately large among asset- and income-poor households. These unequal effects offset a pattern of wealth convergence prior to the storm. In contrast, analysis of the Ethiopian case found that the wealthiest households prior to a drought experienced the largest asset losses during that event. This suggests that the poor may have sought to protect their assets during the drought—or lacked assets to sell or lose—while asset sales and losses among the better off brought them closer to the poor in terms of assets. That is, this event had an equalizing effect on the distribution of assets among households in their sample. Both cases, however, find evidence that the asset levels of many poor households stagnate, or gravitate toward low, sub-poverty levels.

Research has also examined the link between shocks and land sales. Although formal land sales are unlikely in the Ethiopian context given current land tenure arrangements (see

[10] Ability is measured with an estimate of time-invariant inefficiency; net of household attributes and initial herd size.

Chapter 2), non-permanent or informal land transfers do occur and may have important implications for households' agricultural productivity and wellbeing. In Ruben and Masset's (2003) study of income shocks and land market transactions in rural Nicaragua, they find that land-poor and land-rich households were both less likely to sell their land than those from the middle of the land distribution. These differences may reflect land-poor households' reluctance to sell their small plots of land, and the ability of land-rich households to deal with shocks through other means (e.g., selling cattle). Certain disadvantaged groups—female-headed households and former land reform beneficiaries—also had a high probability of engaging in distress sales, which the authors suggest may reflects failure of informal social support mechanisms. And given these particular households' initially disadvantaged position, such sales are likely to affect their long-term ability to support themselves materially. Indeed, many of the households in these groups that engaged in distress sales became completely landless and reliant upon wage labor, sharecropping, and food purchased from the market(s). In short, these sales led to a significant decline in social status and autonomy. Ruben and Masset also find that approximately two-thirds of land transactions took place between households living in the same village. That processes of land dispossession and accumulation took place simultaneously within the same community suggests that shocks may have important consequences for within-community social dynamics.

Considered together, the work of Little et al (2006), Dercon et al. (2005), Hoddinott (2005), Santos and Barrett (2006), Carter et al. (2007), and Ruben and Masset (2003) demonstrate that the effect of shocks, or adverse environmental conditions, are often heterogeneous. These differences likely reveal unequal vulnerability within shock-affected populations. Importantly, these impacts do not vary solely on the basis of wealth. In line with the

multi-dimensional conceptualization of vulnerability outlined above, other social and behavioral factors and processes sometimes mediate the effect of shocks.

The research discussed above also draws attention to an important methodological point: it is difficult, if not misleading to attempt to draw conclusions about a given shock's impact using a single indicator. In Little et al.'s (2006) paper, for instance, the apparently disproportionate impact of drought on asset-rich households' livestock holdings should not be interpreted as evidence that this group was generally worst off during the drought. Rather, herd sales and slaughter may have been a relatively inconsequential response for members of this group to take. In contrast, the poor—who had few if any livestock—may have been forced to reduce their food consumption, or engage in other actions with potentially negative effects. It is not only coping behaviors, but also the motivations and consequences of those behaviors that are heterogeneous among shock-affected communities. Here, integrating qualitative and quantitative data can improve one's understanding of these complexities.

More broadly, the unequal and enduring impacts of environmental stress that are identified in this research have implications for inequality within affected populations. Evidence of inequality suggests that estimates of the average impact across households may conceal systematic heterogeneity. Evidence of enduring impacts indicates that even one off environmental shocks may affect the long-term trajectory of social structure and relations in affected communities. That is, the impacts of, and responses to environmental crises have implications for future economic opportunities and social relationships, which may provide sources of long-term economic advantage (or disadvantage). Indeed, shocks may serve as a mechanism of social and economic stratification within affected communities, and in turn affect communities' resilience to future shocks (Adger 2000). Despite these expectations, however,

there is no evidence of whether, and how household-level variation in the effect of environmental shocks actually contributes to changes in inequality within communities. Some regularities at the household level have been identified, but the impact of differences among these units on aggregate community-level inequality remains an empirical question yet to be answered.

Demographic impacts

Environmental shocks may also prompt changes in human mobility and migration. Given the often-selective nature of migration, it is likely to have implications for the social and economic composition of drought-affected communities. The relationship between the environment and migration has received considerable attention in recent years—particularly as scholars, practitioners, and policymakers attempt to understand the likely demographic impacts of climate change (Bates 2002, Black et al. 2008, Gemene 2011). The conceptual work on environment-related migration has been quite extensive, with a number of scholars developing theoretical frameworks for examining this issue (e.g. Black et al. 2011, Carr 2005, Renaud et al. 2011).

Black et al. (2011) develop perhaps the most comprehensive and nuanced of these frameworks. In it, the environment is one of a multiplicity of direct and indirect factors influencing migration. The demographic effects of environmental changes are likely to vary by the type of migration (e.g. by reason for migrating, distance, and duration), and in some cases may decrease persons' ability or propensity to migrate. This framework highlights the complex and contingent nature of the environment-migration nexus, and provides important considerations for designing empirical analyses of this issue.

Such empirical research on environment-related migration has been limited to date, but a flurry of recent research is beginning to fill this gap (e.g., Gray and Bilsborrow 2013). Published research to date suggests that environmental shocks and longer-onset changes often change the likelihood of out-migration from affected areas; a limited number of studies also explore potential selectivity of environment-related migration. Gray (2009) examined the relationship between land ownership, environmental factors, and migration in the southern Ecuadorian Andres. He argues that environmental conditions may shape migration by providing an amenity (disamenity) that attracts (repels) households, or by serving as a source of natural capital to facilitate (i.e., fund) migration. Results show that agrarian and environmental conditions had significant effects on the odds of local moves, internal migration, and international migration. Specifically, internal and international migration were both negatively associated with mean annual precipitation, which suggests that people were less likely to leave locations with relatively favorable average agricultural conditions for sustained periods of time. Internal migration and local mobility were affected by acute changes in environmental conditions. This result indicates that households may adapt to short-term environmental changes by diversifying their productive and economic activities across relatively limited spaces.

Net of the observed environmental effects, Gray shows that the three types of migration mentioned above were selective of different social, economic, and demographic groups. For example, women were more likely than men to move locally, but less likely to migrate internationally; and mobility peaked between the ages of 25 and 30. Gray also finds that the probability of local mobility was inversely related to the size of households' landholdings. These findings suggest that in contexts affected by environmental change, certain types of households

will be overall more likely to migrate than others. However, it remains unclear whether certain groups' odds of migration are more (less) sensitive to environmental change than others.

In another study, Massey et al. (2010) used data form Nepal to examine the effect of environmental change—as indicated by declining land cover, increasing time required to gather organic inputs, increased population density, and perceived declines in agricultural productivity—on out-migration. They find that local moves were strongly affected by perceived changes in agricultural productivity, and slightly less affected by changing time to collect firewood and land cover. The effect of environmental dynamics on migration to distant locations was notably weaker: perceived declines in productivity and decreased access to organic matter both increased the odds of out-migration to distant locations, but only slightly.

Massey et al. also found that migration to both local and distant destinations was selective of certain groups of people, net of observed environmental events. For instance, women were less likely than men to migrate to any location, as were students and older people. Housing ownership and quality were inversely related to local migration, but were not significantly associated with the odds of distant out-migration. However, social networks did have a significant effect on the odds of out-migration to distant areas. Like Gray (2009), Massey et al. demonstrate that the impact of environmental change on migration occurs in conjunction with a number of other factors upon which migrants are selected. Also like Gray, however, Massey et al. do not explore whether certain groups' odds of migration are affected more (less) by environmental change than others.

Gray and Mueller (2012a) examine the impact of drought on population mobility in rural Ethiopia and find that it increased male labor-related mobility and out-of-district migration. However, marriage migration among females decreased sharply as a result of drought,

demonstrating that environment change can also have an immobilizing effect (see also Foresight 2011). Importantly, Gray and Mueller go beyond pervious empirical analyses and explore potential interaction effects between drought and other factors known to affect migration. They find that the migration odds of particular groups—including land-poor men and women with children—are differentially affected by drought.

Gray and Mueller (2012b) also explore the environment-migration relationship in the Bangladeshi context, and again find evidence of heterogeneous effects. For example, women and the poor are most likely to migrate in response to flooding—particularly moderate-intensity flooding (highlighting potential threshold effects with respect to environmental conditions). Interestingly, they also find that crop failures are most likely to increase migration among those not directly affected but living in areas where many other households (i.e., their neighbors) were severely affected. This finding highlights the importance of considering how the impacts of shocks may be transmitted through social relationships.

Finally, Gray and Bilsborrow (2013) also investigate heterogeneity in the effects of environmental change on multiple types of mobility and migration, with a particular emphasis on gender and farm size. They find significant differences across both factors. For example, migration among men is generally more responsive to environmental changes than among women, which the authors attribute to men's dominant role in agriculture within the study setting (Ecuador). In another example, local mobility and internal migration among the land-poor was more sensitive to environmental changes than other households.

In sum, the literature on environment-induced migration considers one of the potential mechanisms that may underlie environment-related changes in inequality within affected communities. Selective migration affects the social, demographic, and economic composition of

communities. If environmental change exacerbates or changes patterns of migrant selectivity then such demographic responses may constitute an important mechanism linking environmental change to social and economic inequality. Indeed, the types of households that move during periods of environmental stress, where and for how long they remain away, and whether they maintain social and/or economic ties with those who remain in the affected origin, may all have significant consequences for the communities these migrants leave behind.[11]

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Existing research has demonstrated that in many cases, environmental shocks and slower-onset changes have had significant social and economic impacts—particularly across rural parts of the developing world. This research has focused on the potential effects of environmental change on micro-level outcomes, including livelihood strategies, poverty, and migration. Evidence from these studies indicates that environmental changes often do have significant effects on these outcomes, and that the overall odds of experiencing a given outcome in contexts of environmental change may vary according to factors upon which that outcome is usually selected (e.g., different age-specific migration rates). Moreover, a number of studies suggest that individuals' and households' sensitivity to environmental changes varies according to certain social and economic factors, reflecting heterogeneous vulnerability within communities. Finally, this research has produced preliminary evidence that the coping strategies employed by households may involve changes in the distribution of assets and social relationships.

[11] Given the limited empirical research on environment-related migration to date—and its focus on the question of whether the environment effects migration—it is not necessarily surprising that little is known about the social and/or economic ties (e.g., remittances) that environment-induced migrants may maintain with those they leave behind, and what the implications of these ties are for relevant social and economic outcomes. This stands in contrast to the robust literature on migration and development in sending communities more broadly (e.g., De Haas 2010).

Despite this evidence, systematic knowledge about how such shocks affect the distribution of material and social resources within affected communities remains limited. Research is needed to understand how heterogeneous vulnerability to environmental shocks redistributes wealth and restructures relationships among community members, both of which may mediate access to resources in the future. Research should also explore whether and how these distributional and relational effects of shocks affect micro- and community-level vulnerability (resilience) to future environmental changes.

Current study

This study begins to address the gap in knowledge about whether environmental shocks affect social and economic inequality within shock-affected communities, and if so, what social processes underlie such changes. This study focuses on cases of rainfall deficit-affected communities in rural Ethiopia. In this context, rainfall deficits are likely to affect social and economic outcomes via changes in crop production and related changes in an economy highly dependent upon rain fed, smallholder agriculture. That is, household responses are motivated by food insecurity stemming from drought-related crop failures, changes in food prices, livestock losses, changing employment opportunities, and other constraints associated with an environmental shock in this particular institutional context—not by rainfall deficits per se. Since these household responses ultimately shape the distribution of assets between households within the community, the link between rainfall deficits and changing asset inequality is also contingent upon these factors.

Given this assumption, I explore the following questions:

1. Does drought affect the distribution of wealth and assets among households in affected communities?

2. What behaviors underlie observed changes in wealth and assets? What are the potential implications of these behaviors for the short- and long-term wellbeing of households and for community social structure?

3. What factors are associated with differential vulnerability to drought, as manifest in different coping behaviors? Specifically, what factors explain differences between drought-affected households with respect to changes in wealth, productive assets, and levels of autonomy (dependency)?

By addressing these questions, this study represents the first known attempt to estimate the effect of rainfall shocks on inequality within drought-affected *communities*, and to identify explanatory pathways linking rainfall deficits and changes in inequality. Previous research has demonstrated that individual- and household-level effects of environmental shocks often vary systematically among different types of households, reflecting heterogeneous vulnerability. In nearly all cases, such differences at the micro-level will produce aggregate changes in the distribution of resources and other outcomes among households. Indeed, a small number of studies (n=3) have examined the association between environmental shocks and between-household inequality. This research, however, has been limited by poorly chosen geographic units of analysis (e.g., agro-ecological zones) and significant methodological shortcomings. As a result, it is difficult to attribute observed changes in inequality to the environmental shock in question. This dissertation begins to fill this gap by providing more rigorous estimates of the drought-inequality relationship, and examining the processes that may explain this relationship.

Specifically, this study attempts to provide the most robust evidence to date of the association between rainfall deficits and within-community asset inequality by utilizing a combination of large-*n*, quasi-experimental analytic techniques and an in-depth, mixed-methods case study of a rainfall-deficit affected community in rural Ethiopia. It also explores other dimensions of social inequality—particularly food insecurity and micro-social relationships—

that may be integrally linked to changes in household asset stocks. Attention to these underlying processes and relationships (versus studying asset dynamics only) may dramatically affect the conclusions one draws about the distributional and household-level impacts of drought. In addition, this study seeks to identify household characteristics and behaviors that serve as salient axes of differentiation with respect to vulnerability to drought in the Ethiopian context, and as such shape the relationship between drought and inequality within affected communities. Doing so will add to existing literature on the micro-level differentials in vulnerability and, importantly, may represent the first known study to empirically demonstrate how micro-level heterogeneity contributes to changes in community-level inequality.

The study draws upon a diverse set of social, economic, and environmental data from both primary and secondary sources to address these questions. In the second through fifth chapter, I examine survey and interview data collected during fieldwork to develop an in-depth, mixed-methods case study of the effects of rainfall deficits in a single community in rural Ethiopia. This study explores the effects of drought on the distribution of wealth and a set of other related, but ultimately distinct dimensions of social inequality. I place particular emphasis on social relationships characterized by dependency and food insecurity. This component of the study also identifies common sources of vulnerability to drought within the community and, perhaps more importantly, the factors that differentiate households' vulnerability. In the sixth chapter, I use data from the Ethiopian Demographic and Health Surveys (EDHS) and the National Aeronautics and Space Administration's (NASA) Prediction of Worldwide Energy Resource (POWER) project to estimate the effect of rainfall deficits on within-community livestock and asset inequality within rural communities in three, largely highland regions of Ethiopia. This analysis assesses the generalizability of the overall findings from the case study. I

conclude by considering the implications of my findings for theories of vulnerability and environmental inequalities, as well as for methodologies for assessing the social and economic impacts of drought and other environmental shocks in agrarian contexts.

CHAPTER 2: CASE STUDY INTRODUCTION

Introduction

I begin analyzing the relationship between rainfall deficits and within-community inequality through an in-depth, mixed-methods case study of a single drought-affected community in southern Ethiopia. I describe changes in social and economic inequalities associated with rainfall deficits and capitalize upon this ideographic approach to identify processes underlying observed drought-related changes in inequality. These include the heterogeneous motivations and consequences of household coping strategies. Later (Chapter 6), I assess whether the overall relationships between rainfall deficits and within-community asset and livestock inequality, respectively, observed in this case study are generalizable across communities in other regions of Ethiopia.

The specific objectives of this case study are as follows. First, I draw upon data from interviews and focus groups to identify factors that community members themselves associated with vulnerability to rainfall deficits and related crop failures. Second, I identify strategies that households employed in the aftermath of two below-normal growing seasons (2011 and 2012), and analyze the implications of those strategies for the distribution of social and economic resources in the community. Third, I examine the relationship between drought and asset and livestock inequality, and explore underlying patterns of household economic mobility from the start of the first drought year (2011) to the start of the successful growing season after the drought (April-May 2013). Fourth and finally, I draw upon the household survey to identify the household-level factors that were associated with differences in the impact of rainfall deficits on households' livestock and asset stocks.

The case study is developed in four interrelated chapters. This chapter describes the site in which this case study is based and describes the data collection methodology. Chapter 3 reviews key points from the literature review in Chapter 1 to outline the theoretical framework that guides these data analyses. This chapter also identifies and discusses the determinants of vulnerability in the field site as identified by community members. Chapter 4 describes the strategies households employed to cope with food insecurity associated with the below-normal rains, and analyzes the implications of these strategies for households' relative social and economic status. The analyses in Chapter 5 draw upon data from the household survey and examine the association between the rainfall deficits and asset and livestock inequality within the field site; and the factors that explain the heterogeneous household-level impacts that underlie observed changes in inequality. In Chapter 6, I then assess whether the relationships between rainfall deficits and within-community asset and livestock inequality observed in this case study are generalizable across communities in other parts of Ethiopia. Chapter 7, the conclusion, synthesizes the findings of these chapters and draws key theoretical, methodological, and policy lessons.

Data collection

Data for this case study were collected between March and August of 2013, with the institutional support of the non-governmental organization (NGO), CARE-Ethiopia and Cornell University.[12] The objective of this fieldwork was to collect both quantitative and qualitative data about the effect of recent rainfall deficits on households within the study community, and to understand how the impacts of, and responses to these crises affected the distribution of

[12] Data collection for this process received clearance with the Cornell University Institutional Review Board (IRB).

resources and social relationships within the community. I employed three different, but integrated forms of data collection: a household survey, key informant interviews, and focus groups. Taken together, these three data collection techniques sought to identify factors that contributed to vulnerability, broadly defined. An additional goal was to draw lessons relevant to CARE programs that focus on building resilience among the ultra-poor and chronically food insecure in Ethiopia (i.e., government safety net beneficiaries). Specifically, research on these latter topics sought to contribute to the learning agenda for one of CARE-Ethiopia's then-ongoing programs, called, "Graduating with Resilience to Achieve Sustainable Development" (GRAD).[13]

I chose Kejima as the field site for two reasons. First, it had experienced rainfall deficits and subsequent below-normal agricultural production in 2011 and 2012. Such recent experience with environmental shocks allowed for the collection of data to track changes during the crisis—that is pre- to post-shock changes—with as minimal recall demands for reporting pre-shock outcomes as possible. Second, given the programming-related objectives of the survey, research in Kejima offered insights into a community comparable to those that CARE interventions were targeting near Kejima (Hawassa Zuria *woreda*). However, CARE did not target this particular community—or those immediately surrounding it—so programming did not affect the measured outcomes, and the likelihood of respondent bias related to ongoing intervention targeting was reduced.

Quantitative data were collected via a household survey (see Appendix). Given Kejima's relatively small population, I collected survey data from each household living in the community at the time of the survey (April and May). To implement this community census, I constructed a

[13] CARE-Ethiopia provided significant logistic and financial support for this study including transportation to and from the study site, and office space while in Addis Ababa.

roster of all households in the community using a list from the *kebele* chairman, the content of which was triangulated with information from village leaders. Three households were not living in Kejima at the time of the survey.[14] These survey data were collected by a team of six enumerators, who were recruited from a local government office by local CARE staff familiar with this project. All enumerators were competent in English and fluent in the local *Sidaminya* language. I supervised the enumerators with the assistance of a *Sidaminya-* and *Amharic-* (official Ethiopian language) speaking intermediary, who provided valuable reports about enumerators' comprehension of the survey, fatigue, and other factors potentially affecting data quality. This intermediary and I accompanied the enumerators to the field site each day of data collection, and convened a daily breakfast meeting to outline the day's objectives and address problems and questions. I also reviewed completed surveys on a daily basis to identify potential errors that could be corrected the following day. The vast majority of these errors were identified and corrected during a pilot survey implementation and while collecting data in a village outside of Kejima, where formal data collection began.[15]

The survey asked respondents a set of questions about: household demographics; history of government and NGO assistance; experience with other shocks (e.g., household illnesses or deaths); coping strategies employed in the aftermath of shocks; livestock and asset holdings and transactions; food security; land ownership and transactions (including renting); monetary and food transfers (received and given); labor and income generating activities; labor use (i.e., hiring); child school enrollment; community leadership and perceptions of community outcomes; and, among government safety net beneficiaries (Productive Safety Net Program, or PSNP),

[14] Although they maintained houses and fields in the community, these households also spent part of the year in another part of the region (Borecha *woreda*).

[15] Additional household data were collected outside of Kejima (but in Hawassa Zuria *woreda*) for the purposes of meeting CARE research objectives. These data were not collected in the form of a community census or sample, and therefore cannot be used for the current study.

questions about programming and graduation aspirations. The maximum recall period was approximately three and one-half years (from mid-2013 to the beginning of 2010). This is a substantial recall period, and an obvious limit to the analyses below.

I entered all survey data from Kejima manually into a Stata-readable format for analysis. The primary data quality concern regarded the accuracy of reported livestock and asset transactions over time. Respondents were asked to identify the number of each livestock and asset type that they owned at the time of the survey, at the beginning of 2010, and all transactions between those two points. One could therefore determine whether the number of livestock reported in 2010 was consistent with current holdings net of between-period transactions. In instances in which the reported and estimated 2010 livestock holdings were not equal, the estimated figure—that based on 2013 holdings net of transactions—was used since the 2010 estimate had the highest risk of being affected by recall bias.

Many of the other covariates in the statistical models are time invariant or easily recalled. For example, I assume that most households can recall the year that household members were born, or when they began and/or ceased receiving government benefits through the PSNP program. However, the accuracy of reporting on a number of other factors, such as borrowing and lending, food security, and exposure to other shocks, is less certain. This is an inherent limitation of addressing this research question using a single cross-section, and should motivate future data collection efforts (see Chapter 7).

Qualitative data were collected through a series of semi-structured interviews (n=33), informal background interviews, and two community focus groups. I conducted these interviews and focus groups with the assistance of an interpreter. With the exception of one focus group and one interview, all of the interviews and focus groups were conducted with the same *Sidaminya-*

speaking translator; the other focus group and interview were both conducted with the same substitute translator. Both interview respondents and focus groups were asked a series of questions on the following topics: (a) recent experience with environmental shocks, including coping strategies; (b) perceptions about differences in the effect of these shocks among community members; (c) community-level changes; (d) the meaning of "vulnerability" and "resilience" in Kejima; (e) perceptions of PSNP operations and opportunities/constraints for PSNP graduation; and (f) background information on the economy, governance, natural resources, and community organizations in Kejima.

Participants in the qualitative interviews were purposively selected on the following characteristics: age/generation; gender; community leadership; PSNP participation; wealth; and land ownership. Each of the focus groups included male (n~10) and female (n~7) adults, respectively. Key informant interviews were also conducted with the *kebele* chairman, two *kebele* deputy leaders, an agricultural extension worker, a CARE "community facilitator" stationed in the *woreda*, and two officials from the *woreda* government.

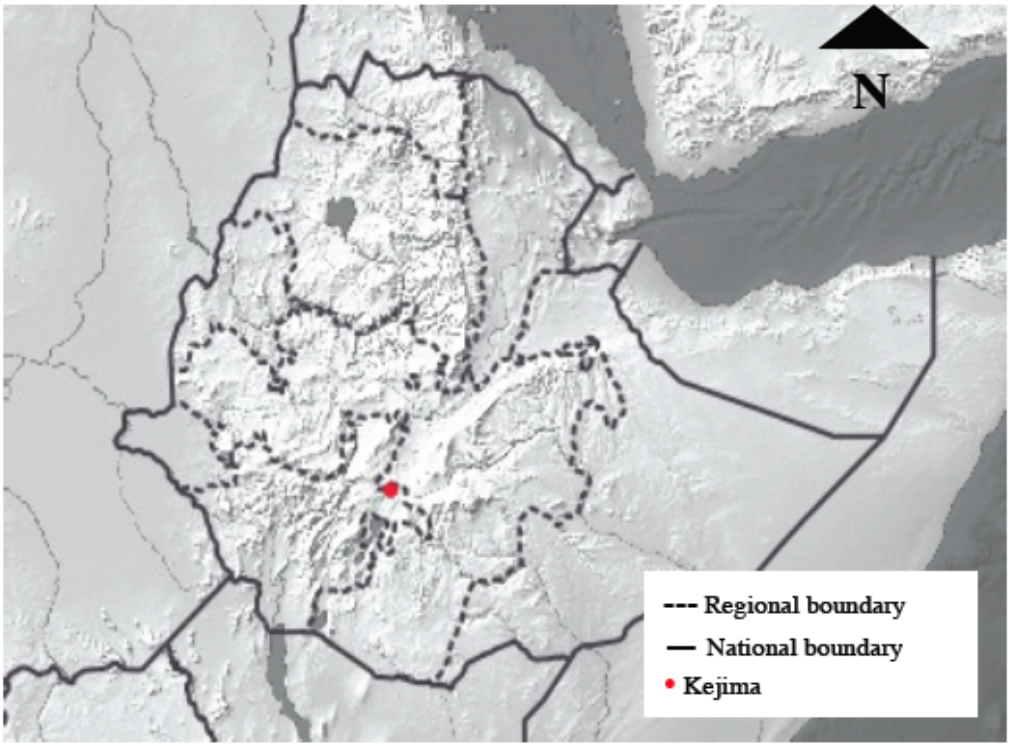
Case study field site[16]

Location

This case study examines social, economic, and ecological dynamics in a rural community in south-central Ethiopia—more specifically in the Sidama Zone of the Southern Nations, Nationalities, and Peoples' Region (SNNPR). Within Sidama zone, the study community is located in Hawassa Zuria *woreda*, which is an Ethiopian equivalent to a United States (US) county. Hawassa Zuria is located to the south and west of Lake Hawassa, beginning

[16] Statistics about Kejima are based upon data from the household survey unless otherwise noted.

on the western edge of the city of Hawassa, which serves as the administrative capital of SNNPR (see Map 2.1)



Map 2.1 *Location of field site with national and regional boundaries*

Within Hawassa Zuria, this case study focuses on a community of 95 households living in a cluster of four villages—Umbolo, Gamacho, Badecho, and Hanashame. These villages are located in Kejima *kebele*, which is comparable to a US township or other sub-county administrative unit. Hereafter, I will refer to this four-village community as Kejima. The villages that constitute Kejima are located contiguously to each other, and are largely separated from other villages by agricultural fields, deep ravines, and a steep hillside. Of the 95 households in Kejima 10 (63 people) are located in Umbolo, 18 in Gamacho (118 people), 28 in Badecho (170 people), and 43 in Hanashame (291 people).

Social and demographic characteristics

The households within these villages constitute a distinct community in the sense of sharing a place of residence and being exposed to similar environmental conditions, which are a key factor in local livelihoods. Kejima also represents a locus of social, political, and economic activity. For example, churches, savings groups, and groups focused on agriculture and development include residents from all four villages. Likewise, local government meetings are usually located at a central location in Hanashame, drawing residents from all four villages. Anecdotal evidence from interviews also suggests that residents are more likely to know and interact with other residents of Kejima than with individuals from other communities.

Yet there are a number of important qualifications to the categorization of Kejima as a unified community. For one, there are discernable patterns of, and barriers to social interaction within Kejima. In many cases, these social boundaries fall along the administrative lines and physical boundaries (e.g., ravines) that separate the four villages within the community. Although the administrative lines are rather recent political artifacts, they nonetheless shape patterns of social and economic interaction, knowledge sharing, and—according to some residents—local government resource allocation. In short, individuals may be more likely to interact with other individuals from within their own village than with those from other villages in Kejima.

In addition to internal divisions, the bounded-ness of Kejima is destabilized by connections, flows, relationships, and interactions with external actors. As perhaps the most obvious example, an unimproved road connecting two significant local markets runs through part of Kejima, and is no more than 5km from any home in the community. As a result of this road, individuals from outside of Kejima—and sometimes far outside of the region—frequently pass

through the community, often buying or selling goods and exchanging information. Households in Kejima also frequently travel the road to collect water, visit local markets, graze animals at the roadside, and engage in other similar activities.

Land

Given the centrality of agriculture to livelihoods in Kejima, land is the single most important resource in the area. Legally, land is state owned in Ethiopia. This tenure system dates back to the overthrow of Emperor Haile Selassie in 1975 (Crewett et al. 2008). Under it, households hold usufruct rights that are typically passed down from fathers to their sons at the time of marriage.

The current distribution of land in Kejima reflects historical settlement patterns; government land allocations and reallocations; land grabs during previous periods of social and political unrest; and family social and demographic histories (e.g., births and deaths, out-migration). For example, one respondent explained,

> It was in the last regime—in the Derg regime that people were going… and buying the land from the poor, poor families. But now there is no land even for buying. You may only get some contract lands in other villages, and some are just asking to work together and to share that production from that land.

Another observed,

> The population is increasing, and access to land is also decreased. That means, if the population number increases, the chance of getting land decreases.

Such responses were extremely common.

Land 'ownership' in Kejima generally ranges from less than a tenth of a hectare to two hectares.[17] In 2013, the average household landholding was approximately a half-hectare (Table

[17] 1 hectare is equivalent to 2.47 acres, or 0.01 square kilometers.

2.1). With respect to the distribution of households by landholdings, Table 2.2 shows that only three (3.2%) of the 95 households in Kejima had control of more than a hectare of land. Two households have extremely small landholdings of 0.1 hectare or less. With only 0.02 hectares—not enough for even a substantial garden—one of these two households is effectively landless.

Table 2.1 *Summary of Kejima household landholdings, 2013*

Mean	Median	SD	Min	Max
0.49	0.32	0.32	0.02	2

Source: Kejima Household Survey

Table 2.2 *Distribution of Kejima households, by landholdings (ha)*

Hecatres	N	%
$y \leq 0.1$	2	2.1%
$0.1 < y \leq 0.25$	24	25.3%
$0.25 < y \leq 0.5$	41	43.2%
$.5 < y \leq 0.75$	16	16.8%
$.75 < y \leq 1.0$	9	9.5%
$y > 1.0$	3	3.2%

Source: Kejima Household Survey

Land use rights cannot be sold permanently through the market (or other mechanisms), with the exception of father-to-son inheritance and rare cases in which an individual cedes his land to another community member (usually a relative). However, there is an informal market for land sharing rights and short-term contracts in the community. These exchanges address a mismatch between (a) households with land but without the capacity to fully invest in the inputs needed for agricultural production; and (b) households with the capacity to purchase seeds and fertilizer and provide labor for agricultural production. In sharing agreements, the individual with land but limited productive capacity will partner with an individual with inputs and labor capacity, who will purchase seeds and fertilizer for the crops. Both parties will share the labor responsibilities for the plot, and will divide the output at harvest—usually on a fifty-fifty basis.

These agreements provide those with the capacity—and willingness to take the risk of a failed harvest—to expand their production beyond the land they have official rights to; while those who own land but lack capacity or risk tolerance can still maintain the possibility of realizing relatively high levels of production from their land.

In contrast, so-called "contract" agreements are simple rentals in which an individual will pay a landowner rent for exclusive use of part or all of their land for the year. There is no labor or output sharing in these agreements. Data from the household survey suggest that at least 10% of households in Kejima engaged in some form of land transfer between 2010 and 2013.

Such sharing and contract agreements are important—likely more so than the estimate suggests[18] —given the land tenure system and the lack of available land for extensive agricultural development. Indeed, there are currently no significant tracts of unused land in or around Kejima, which reflects the region's historically high rates of population growth.[19] Given these constraints, permanent landholdings among families have been relatively static in recent years, and will almost undoubtedly remain fixed in the short-run. Land distribution patterns in coming years are therefore mainly contingent upon within-household demographic dynamics—primarily the number of male children who form households in the community as adults.

Livelihoods

Livelihoods in Kejima are centered on rain-fed agriculture, particularly maize production. In 2013, all but one household planted a maize crop. More than a third (36.8%) of households

[18] This is almost undoubtedly an underestimate because the survey focused on rental agreements and transfers; the importance of sharing agreements was not clear until a series of in-depth interviews were completed.

[19] Ethiopian population dynamics are driven by a complex array of underlying social and economic factors (Desai and Tarozzi 2011, Lindstrom and Berhanu 1999, Tadesse and Headey 2012), but in this case, the proximate cause of growth is almost certainly declining death rates without offsetting declines in rates of birth or out-migration. Evidence from other studies (e.g., Shapiro and Gebresselassie 2008) and anecdotes from interviews suggests that these demographic patterns are changing—if only modestly.

planted haricot bean, often in an intercrop with maize (Table 2.3). A majority (62.1%) of households planted *ensete* (false banana), with potato (10.5%) and sweet potato (1.1%) less common.

Table 2.3 *Frequency of select crops planted in 2013 by Kejima households*

Crop	N	%
Maize	94	99.0
Haricot bean	35	36.8
Enset	59	62.1
Potato	10	10.5
Sweet potato	1	1.1

Source: Kejima Household Survey

The types of crops, and proportion of a given crop that a household plants may be contingent upon the size of its landholdings. Anecdotes from qualitative interviews suggest that land size is particularly important for households' decisions regarding planting *ensete* (false banana). *Ensete* is a relatively drought-resistant plant, so it can serve as a critical source of food security in drought-prone contexts; humans commonly consume the root, and leaves are used for animal forage. However, the *ensete* plant also takes considerable time to mature—upwards of four to five years. During this time, the land it is planted on is effectively out of use. Households with relatively small per capita landholdings—or other forms of economic disadvantage—are therefore particularly unlikely to plant large amounts of *ensete*.

All households in Kejima owned at least one species of livestock or farm animal. Cattle, chicken, and oxen are the most commonly held. Almost all (94.7%) households own at least one head of cattle; majorities own at least one chicken (55.8%) and oxen (52.6%), respectively (Table 2.4). Goats (34.7%), sheep (31.6%), and donkey (32.6%) are somewhat less common, and only two (2.1%) households own at least one horse. Of course, these counts do not account for

herd sizes, which vary markedly across households. For example, among households that own at least one goat, herd sizes range from 1 to 20. Inequality with respect to livestock ownership will be discussed further in Chapter 3.

Table 2.4 *Frequency of Kejima households owning 1+ of select livestock types, 2013*

Crop	N	%
Cattle	90	94.7
Oxen	50	52.6
Goats	33	34.7
Sheep	30	31.6
Donkey	31	32.6
Horse	2	2.1
Chicken	53	55.8

Source: Kejima Household Survey

Livestock constitute a source of food as well as a store of wealth. Those with large herds of cattle, for instance, are considered among the better off in the community. Livestock sales are also a relatively liquid store of wealth, and as such are often sold in periods of stress or crisis. For example, many households will sell livestock in the local market to obtain money for food to fill gaps between food production and consumption needs in years with poor harvests. Of course, livestock may also die or be slaughtered for food during periods of stress. Livestock may also represent an investment. Some households—particularly those with savings or access to credit—engage in livestock fattening operations, which involve increasing the weight of cows, sheep, and/or goats so they can be sold at relatively high prices. In many cases, individuals will begin by fattening sheep and goats, and then reinvest their profits to "upgrade" to cattle fattening. This is considered a key means of upward economic mobility to Kejima.

At least one member of nearly all households will engage in a food- or income-generating activity beyond agricultural production on their own farm. These activities are highly gendered.

Men frequently work on other households' fields for food or wages; trade or broker livestock in the market; operate local donkey transportation services; or engage in arbitrage of agricultural produce between villages or in local markets. Women tend to work by processing foods (e.g., *ensete* flour production) for other households or to sell in local markets; and women may also engage in petty trading.

In 2013, 33 (34.74%) Kejima households received government food and cash transfers for six months of the year via PSNP. In exchange for manual labor in public works projects, PSNP beneficiaries receive food (three months per year) and cash transfers (three months per year).[20] PSNP is intended to provide a safety net for the poorest and most food insecure households in the community by (a) diminishing the odds that they will engage in detrimental coping behaviors (e.g., selling productive assets, removing children from school) during periods of stress; and (b) increasing the odds they will accumulate savings and make productive investments in good years (e.g., improved seeds, fertilizer, children's education) (Andersson et al. 2011, Sabates-Wheeler and Devereux 2010). The public works requirement is intended to mobilize community labor to improve public goods, such as roads or forests. Quotas limit the number of PSNP beneficiaries by *kebele*; benefits are targeted to assist the most needy, with varying degrees of success as a result of political processes and the relatively narrow wealth differentials within the community.

Markets

Residents of Kejima participate mainly in two nearby markets. The first, called Shamana, is located approximately 6km to the northwest of Kejima, atop a steep hillside that borders the

[20] Some populations—such as the elderly and disabled—are exempt from public works projects. Nationally, only 16% of PSNP recipients received such 'direct support' in 2008 (Sabates-Wheeler and Devereux 2010).

community. This is the primary market for community members. It is where they buy and sell agricultural goods, livestock, clothes, food from outside sources (e.g., salt), and petty goods, such as credit for those with mobile phones. In previous times, Shamana had been a place of exchange with inhabitants of the neighboring Oromiya region, who would often purchase goods from Kejima residents in Shamana to re-sell in more distant markets. According to interviews, this trade has diminished in recent years as Oromo trade has been reoriented to the north—reportedly much to the detriment of local producers. Shamana is connected to the administrative capital, Dore, by the road that runs through Kejima. A local bus, motorcycle taxis, and occasional cargo truck service this road. However, hiring transportation on these options is too expensive for residents of Kejima to regularly afford. Most are indeed "living in a walking world" (Porter 2002).

The second market is located in Dore, approximately 8km to the southeast of Kejima. Dore was recently established as the administrative capital of the *woreda*. It is growing rapidly and hosts a robust livestock market, as well as small shops, coffee stands, and restaurants that primarily service government officials. A local bus and a rapidly increasing number of motorcycle taxis run between Dore and Shamana, as well as between Dore and Hawassa. Hawassa is a moderate-sized city—with a population over 225,000 (Central Statistical Agency 2013)—and the administrative capital of SNNPR. It is located approximately 45km to the east of Kejima. Although residents of Kejima cannot afford frequent transportation between the community and these towns, many people and commodities flow between Dore and Hawassa. Dore therefore serves as an important node of social and economic exchange between the people of Kejima, other parts of Ethiopia, and even international circuits of commodity exchange. The Pepsi soda available in Dore's two restaurants exemplifies these connections.

A third local market town, Darba, is located approximately 5km south of Kejima. Despite its relative proximity, Darba is a secondary market for residents of Kejima because of its small size and relatively distant location vis-à-vis the main road and other population centers.

It is important not to overemphasize the spatial and economic connections that these markets provide residents of Kejima. Interviews suggest that in practice, the community has very limited connection to regional, national, and global markets. Virtually no local production is exchanged beyond Shamana, Dore, or Darba; and aside from petty food items (e.g., salt), clothing, and, for few residents, mobile phone credits, Kejima residents do not have the resources needed to purchase goods that come from external markets.

Fertilizer and improved seeds are important exceptions. According to community members, these inputs are necessary for agricultural production, especially given declining soil quality and the low reliability of local seed varieties. Both fertilizer and improved seeds are sourced from national and international markets, and as such prices are not necessarily responsive to local conditions. Most people in Kejima access improved seeds and fertilizer through government channels, although many utilize private sources of credit to purchase these inputs. In 2013, the government responded to local complaints about input prices and allowed some households to pay for their inputs in two installments—including one after the harvest, when households were more likely to be able to sell their production for money rather than rely upon loans.

Perhaps surprisingly, nearly all transactions are monetized in and around Kejima. For example, if a household wanted to exchange their cow for a certain amount of maize, they would have to sell their cow to a livestock trader in the market for cash (Ethiopian *birr*, or ETB), and then use those ETB to purchase food from a separate vendor in the market. The same holds true

in the labor market: on-field work is often remunerated in ETB; although, as will be described later, workers may be paid directly in food during periods of environmental stress.

Governance

The Ethiopian government is structured as a federation, with nine ethnicity-based regions and two independent cities (Aalen 2011, Mengisteab 1997). Governing units are nested in a hierarchical arrangement from the *kebele* up to the federal level. The *kebele* is the smallest official unit of government, with a chairman and deputy chairman elected directly by their constituents (i.e., all men and women over the age of 18). *Kebele* chairmen are responsible for maintaining lines of communication between the people of the *kebele* and the *woreda* government, and lobbying on behalf of the *kebele* when necessary. Issues that chairmen commonly deal with include fertilizer and improved seed prices and distribution; environmental and food crises in the *kebele*; agricultural and health training; and PSNP targeting and distribution. Given the direct election of *kebele* chairmen by fellow community members, there is often significant formal and informal pressure to make claims on behalf of the community. Indeed, the people of Kejima have removed ineffective and corrupt chairmen from office in the recent past.

From the perspective of most households in Kejima, the decisions of the *woreda* government have the greatest consequences for their wellbeing relative to other levels of administration. The *woreda* is the lowest level of government at which there is an established bureaucracy with the power to allocate resources—including PSNP benefits, credit, food aid, and extension services. When households in Kejima report a problem or request resources to the *kebele* chairman, they expect a response from the *woreda* government—even if the *woreda* is

ultimately dependent upon resource allocation from higher levels within the federation (e.g., zonal government). As a result, the *woreda* is effectively the face of the Ethiopian state for households in Kejima and many other rural Ethiopian communities. Notably, employment in the *woreda* government is also seen as highly desirable, despite (or perhaps because of) complaints of widespread corruption and negligence.

Above the *woreda*, district, zonal, regional, and federal governing bodies operate in a hierarchical manner in which policies are transmitted down from one level of government to the other. Theoretically, reports of problems and demands are also transmitted upward through the federal structure. In interviews, many residents of Kejima reported feeling disconnected from governing bodies above the *woreda* level. Sporadic visits by officers from the district agricultural office were generally the most substantial interface between the people of Kejima and supra-*woreda* officials. Some community members see this in a positive, or at least benign light. For example, one respondent explained,

> We are not expecting the higher-level government officials to come to us and move about us and see us. The government is structured so that there is a *woreda* and some *kebele*. The government also sends DA [development agents] among us, and extension workers—health extension workers. They are moving here and there, and looking at our problems. They are supporting us. By that way I think the higher government officials are also helping us because they have representatives here who work with us.

Others suggested that supra-*woreda* levels of government neglect them. As one respondent said,

> Those who are at…the regional level and the federal level are…just considering us like cattle. They are not responding to our questions. They just eat for themselves, build houses for themselves, and send their children to good schools. They are not thinking about us. I don't think that…the region and the federal government are responding as we want.

Higher levels of government nonetheless have important effects on life in Kejima through policies that affect PSNP distribution, food, aid allocation, agricultural extension policies, and

seed and fertilizer price setting. Is not clear the degree to which these policies are actually driven by, or sensitive to on-the-ground situations or demands.

Adult Ethiopians have voting rights in elections of sub-federal officials and representatives in the national House of Representatives, the latter of which has power to elect key federal officials. Despite many of these democratic processes, a single political coalition, the Ethiopian People's Revolutionary Democratic Front (EPRDF)—and largely a single cadre within that party—dominates the Ethiopian government. This severely limits debate and opposition about contentious issues. Nonetheless, participation in local governance is quite high in Kejima. According to most interview participants, the vast majority of adults regularly participates in community meetings and votes in local elections. Moreover, participation in community governance and elections does not fall along traditional gender or wealth lines. It is not necessarily the poor or excluded (e.g., female-headed households) that do not participate, but those who believe that community meetings are simply too time intensive.

With respect to potential forms of exclusion in the political sphere, however, it is worth noting that the *kebele* government recently established a group with the specific objective of communicating the needs or demands of women to the local government. Although women attend the main community meetings, the existence of this organization—and data from qualitative interviews—suggests that they are often marginalized or hesitant to speak during these community-wide meetings. In other words, their presence at community meetings often does not translate into true participation. The establishment of this group suggests that local leaders are interested in giving women a more substantive voice in the community. However, the degree to which the opinions of this separate group are taken into account is not clear. Such a parallel group may, in fact, give women in the community a false sense of empowerment.

Finally, it is also important to point out that in recent years, the governance structure has been extended to a neighborhood level through the establishment of so-called "development cells" through the "five-to-one" program. Each *kebele* has been split into *goats (*villages), each of which includes 40 to 50 households and is assigned a leader. Each g*oat* is further divided into five-household cells, and each cell is also assigned a leader—hence the name "one-to-five". Ostensibly, these cells are intended to improve communication between households and the government, particularly with respect to development-related issues (e.g., seed and fertilizer needs, agricultural techniques, crop or livestock disease, financial management). However, respondents' descriptions of these cells suggest that they may also serve as a mechanism for requiring households to implement government-approved agricultural practices, with neighbor-to-neighbor monitoring of details including specific levels of fertilizer use. As such, these cells may encourage self-policing within the community. Although reports of, for example, neighbors monitoring another neighbors' fertilizer application may be relatively benign, there is significant potential for abuse. The relatively authoritarian nature of the Ethiopian government, and a history of draconian rural development programs, suggest that this "one-to-five" program may be cause for concern (Hammond 2008, Tareke 2009).

Community organizations

With few exceptions, the government sponsors all formal civic organizations in Kejima. Notions of an autonomous civil society (vis-à-vis the state) are not relevant in this context, although a number of organizations with non-political goals exist. Organizations in the community include savings and microcredit groups; funeral insurance groups; development-oriented associations; political leagues; and a recently started cooperative that is attempting to

improve access to agricultural inputs. Intentionally or not, gender, age, and wealth strata segregate nearly all such groups. For example, only adult women are eligible to participate in the microcredit organization; and separate development associations and leagues exist for men, women, and youth. Likewise, savings groups are only eligible to those with enough money to save and, in the case of house building groups, aspirations to construct an improved (i.e., corrugated iron-sheet) house.

International non-governmental organizations (NGOs) have operated in Kejima during recent years, albeit quite rarely. In interviews, respondents recalled only two recent interventions. First, an NGO named GOAL implemented a women's health training program between 2005 and 2010. This training provided the foundation for a health education extension program that is currently run by the local government. Second, the Czech development agency People in Need implemented a conservation program in 2012, which involved tree planting along the steep hillside that runs along the northwest part of Kejima.

Nearly all of the aforementioned organizations and projects—from government-sponsored groups to NGO development projects—provide the possibility of improving extremely poor households' wellbeing through savings, credit, or learning. As such, individuals in Kejima are highly incentivized to participate; unsurprisingly, respondents did not mention any pressure or coercion to participate.

Ecology

On average, communities in Hawassa Zuria sit at an elevation of approximately 1,750 meters, with a number of markedly higher elevations. In the relation to the Bale Mountains towering to the east, Hawassa Zuria appears to be a relatively lowland *woreda;* and indeed, it is

technically located in the Great Rift Valley. Technically speaking, however, it is considered a part of the temperate middle highlands (*wayna dega*) (Livelihoods Integration Unit 2010).

Kejima is located at the base of a steep hillside. This slope rises approximately 200 meters over the course of only 0.5km. Most agricultural plots in the area have a discernable slope, but only a small minority of households control land that is too steep for viable agriculture. However, the hillside is at the root of a number of significant environmental problems related to rainfall run-off. Major deforestation during previous decades has increased the severity of this problem by reducing barriers to downhill water flows and exposing loose topsoil to the elements. Often-violent downhill flows of water leech nutrients from the soil and cause significant physical erosion, including a major ravine cutting through the villages. These problems are particularly acute for those located in the central and western parts of the community, where the ravine formation and water runoff and erosion problems are most severe.

A number of households in this area have lost upwards of one-quarter hectare of land as a result of ravine formation. During interviews, a large proportion of households reported declining agricultural productivity and attributed it to erosion and nutrient leeching. The descriptions of two male community members are representative. The first explained,

> My land is not as productive as five or six years ago… Before six or seven years, we were not using this fertilizer as an input. We simply planted with seed, and we got good production. Right now, even though we are using fertilizers like DAP and urea, we are not getting as much production as we got five or six years before. The quality of land is very much decreasing.

The second respondent said,

> I heard from my father and my grandfather that our land was very fertile in the past, giving good production…without using fertilizer and improved seed. Right now, even though we are using fertilizer and improved seed, the quality of my production is very low… I don't get the production that I need—as much production as I need. It's obvious that the quality of my soil has just eroded and

right now it's not good. It's not as much as before.

Given the major land constraints in the area, nearly all of the available land is put under production each year; no significant fallowing of land was reported by any respondent or key informant. Moreover, households plant maize as the primary crop each year. Such repeated monocropping—or in some cases maize and haricot bean intercropping—may have soil-depleting effects above and beyond those stemming from the lack of fallow (Thierfelder et al. 2013).

These historical declines in land quality have been rather uniform among households in Kejima, but there is significant spatial variation in absolute levels of land quality. As mentioned above, central and western areas of the community suffer from particularly poor land quality. Agricultural plots in these areas tend to have the steepest slopes and are subject to particularly intense water runoff from the surrounding hillside. These topographical features have a number of implications for land quality, including increased risk of flood-related crop damage; loss of nutrient-bearing topsoil to downhill plots; and the formation of deep ravines. These have destroyed significant portions of some households' land and created a dangerous physical barrier separating some households in the community from each other, and from the road.

Aesthetically, the landscape of Kejima varies greatly according to rainfall, with stark differences on seasonal and annual bases. The dry season runs from approximately October to March. In Kejima—and many other parts of south-central Ethiopia—the distribution of rainfall is typically bimodal. Throughout the "rainy season", *Belg* (short) rains tend to fall in March, April, and May; and the *Kiremt* (long) rains typically fall from June through September. Rainfall is Kejima has been classified as a *Kiremt*-dominant bimodal distribution (Livelihoods Integration Unit 2010, USGS 2012).

The timing of planting and harvesting is tightly linked to these rains, as well as to the particular crops and seed varieties used by farmers. Unlike other parts of the country, however, farmers in Kejima commonly plant long-cycle maize crops during the onset of the *Belg* rains, harvesting them at the culmination of the *Kiremt* rains. Other crops may be planted on a short-cycle basis in both periods of the rainy season (Livelihoods Integration Unit 2010). Related to these rainfall, cropping, and harvesting patterns, the "hungry season" typically spans from February to June.

During the dry season—or entire years when rains have failed—the landscape is extremely desolate, with little vegetation and dry, dusty soils. In contrast, the landscape is extremely verdant and lush during successful rainy seasons, with deep green vegetation and dark, moist soils. The extreme seasonal variation in the landscape is due in part to the scarcity of trees and other permanent vegetation, with the main exception of cactus fences planted to separate households' homes and fields. Seasonal crops are the primary source of vegetation in Kejima; hence the landscape is contingent upon maturity of the crops. Of course, this is not simply an aesthetic issue given the previously mentioned link between deforestation, erosion, and nutrient loss. The lack of permanent vegetation may also have implications for the area's microclimate (DeFrenne et a. 2013).

There are no naturally occurring sources of safe drinking water in the community, although households will nonetheless sometimes use water from constructed ponds and seasonal streams flowing through the ravines. Two government-operated water pumps are located within 5km of the community, and Lake Hawassa is located approximately 10km away. Despite the relatively close proximity to the lake, no households reported utilizing the lake or lake-related natural resources. Households must pay to access the pump water, at a rate of approximately 10

US cents per 20-liter jerrycan in the rainy season, and 15 to 20 US cents per 20 liters in the dry season. In addition to higher dry season costs, households face physical scarcity of potable water during that time. According to interviews, people often must wait for water through the middle of the night during the dry season.

The pipe supplying the two primary water pumps used by Kajima residents runs under part of the village itself. The choice of pump location may be a function of population density (i.e., the pumps are located in areas where the most people can access them), but community members expressed dissatisfaction with the government officials that made these decisions. Similarly, a functioning electricity line runs through part of the village, but there are no outlets for households in Kejima to access it.

Conclusion

This chapter has outlined the objectives of the case study, described the data collection methodology, and provided a sketch of the social and environmental context of Kejima, the rural Ethiopian community in which this case study takes place. In doing so, this chapter has demonstrated that Kejima is an appropriate place to examine the relationships between recent environmental shocks and within-community social and economic inequality. The following chapters proceed with an empirical analysis of these relationships and then, in Chapter 6, consider whether the Kejima case is generalizable to drought-affected communities in other regions of Ethiopia.

CHAPTER 3: VULNERABILITY IN KEJIMA

Introduction

Through my review of the literature in Chapter 1, I suggested that the effect of environmental shocks on between-household inequality within communities is contingent upon the distribution of vulnerability. Without differences in shock-related outcomes between households, environmental shocks will not affect inequality within these communities (although absolute levels of relevant household outcomes may change). Given the importance of vulnerability, and differences therein, to the overall focus of this dissertation, this chapter identifies factors that likely differentiated households' vulnerability to rainfall deficits and related food crises in Kejima. As such, these factors form the basis for expectations of how between-household inequality in Kejima may have been affected by recent rainfall shocks. Drawing upon data from semi-structured interviews and focus groups, I discuss the factors that residents of Kejima identified as correlates of vulnerability in the community. Throughout the chapter, I contrast vulnerable and resilient households, using the latter term to simply describe households with the ability to endure environmental crises and other fluctuations without a detrimental loss of essential social and economic resources.

Recalling Chamber's definition of vulnerability as the product of a household's exposure to a given shock and ability to cope during and after that event without experiencing damaging losses, this particular framing of resilience represents a direct contrast to vulnerability (Chambers 2006). Of course, I acknowledge that the term resilience is highly contested in the academic literature and non-peer reviewed research produced by NGOs and think tanks (e.g., Adger 2000, Barrett and Constas 2013).

As a preface to the analysis in this and subsequent chapters, I begin by recapping key points from the review in Chapter 1 and outlining a theoretical framework for thinking about the relationship between vulnerability, coping strategies, and social and economic inequality in agrarian settings.

Theoretical framework

Existing literature on vulnerability to environmental change makes two important theoretical contributions. First, it suggests that vulnerability—a function of exposure, sensitivity, response, and recovery—to environmental shocks often varies systematically within affected populations. It further traces this heterogeneity to historically constituted differences in social, economic, and environmental resources. Second, previous work—particularly that on coping strategies—emphasizes that households often exercise agency and act strategically in contexts of perceived risk or crisis. They are not simply passive victims in the face of environmental change. Within the constraints associated with vulnerability, households instead negotiate between complex sets of social and economic objectives. These objectives include, for example, remaining within socially defined boundaries (e.g., gendered occupations); participating in informal inter-household redistribution systems; maintaining food security; securing or protecting long-term economic prospects; and gaining economic advantages vis-à-vis other households in the community (De Waal 2005, Watts 2013). Indeed, households' constrained and differentiated responses to changes in social and economic conditions brought about by environmental shocks may contribute to the production of new, post-shock social structures (macro-social) and relationships (micro-social).

With respect to community social structure, this dissertation places particular focus on the distribution of wealth within affected communities, and two underlying issues: (1) households' positioning vis-à-vis resources and relationships that may be associated with forms of cumulative advantages (disadvantages) into the future; and (2) micro-social relationships that mediate the distribution of resources during crises and over longer periods of time.

The distribution of wealth and other social and economic resources is a longstanding topic of research among sociologists and development scholars alike (e.g., Keister and Moller 2000, Mogues and Carter 2005). Wealth disparities not only reflect historical processes of stratification, they also have likely implications for future wealth accumulation trajectories, opportunities in the economic sphere, and other outcomes associated with wealth inequality (e.g., health, political power).

Indeed, there is a tight link between levels of macro-level resource distribution and micro-level economic outcomes. This has been explored in the sociological literature on cumulative advantage over the life course, and is implicit in the literature on agrarian differentiation and notions of non-linear wealth trajectories in the literature on poverty traps in developing counties (Akram-Lodhi and Kay 2010a, Akram-Lodhi and Kay 2010b, Dannefer 2003, DiPrete and Eirich 2006, Carter and Barrett 2006, Carter et al. 2007).[21] Here, it is important to distinguish between conceptualizations of cumulative advantage as a description of diverging wealth trajectories versus a set of causal mechanisms that explain processes of stratification between groups (DiPetre and Eirich 2006). The former is exemplified by mathematical truisms, such as the relationship between initial and future wealth under conditions

[21] I focus on wealth. However, research on cumulative advantage was initiated, and continues with a focus on other outcomes, such as crime, health and human development, and as Merton's original research centered on, the status of scientists (DiPrete and Eirich 2006, Merton 1973, Wilson et al. 2007).

of compounding interest. The latter, however, requires the interrogation of the social and economic conditions that explain long-term advantages enjoyed by some households or social groups vis-à-vis others. Such explanations range from notions of exploitation of labor by capitalists (i.e., surplus value extraction) to other non-class based forms discrimination and disadvantage, including those based on social categories (e.g., race or ethnicity; patron-client networks) and other individualistic factors (e.g., skills and ability).

Given the geographic focus of this dissertation, the literature on peasant differentiation and agrarian change in developing counties is perhaps most relevant. This body of work has explored sources of stratification among peasant societies, placing an emphasis on the imperative to accumulate capital among agrarian households (if only to purchase food or agricultural inputs from the market). In contexts where such logic prevails, the role of initial land and wealth endowments, as well as access to labor and other agricultural inputs, are salient determinants of households' long-term trajectories (Akram-Lodhi and Kay 2010a, Akram-Lodhi and Kay 2010b, Gray and Dowd-Uribe 2013).[22] Those with the capacity to hire labor, purchase inputs, and thus realize relatively robust agricultural production and profit are more likely to experience upward mobility and resource accumulation than those who lack such initial capacity. The latter households are often forced to sell their labor and other resources to maintain subsistence, and thus face declining or stagnating economic welfare. Importantly, however, this literature also acknowledges the historical and spatial specificities of such processes (Bernstein 2004, Gray and Dowd-Uribe 2013). Attention to contextual idiosyncrasies is particularly important given the unique property tenure systems in Ethiopia vis-à-vis other sub-Saharan African counties. For

[22] In some respects, this emphasis reflects the materialist leanings of these scholarships. However, it is also consistent with other literature reviewed above, which suggests that control over basic resources is a salient factor differentiating households, and household vulnerability (resilience) in areas characterized by extreme and chronic poverty.

example, one might expect that formal land sales are unlikely to be a major feature in processes of accumulation in Ethiopia as a result of the unique land tenure system there.

Following existing research, this analysis will focus largely on the processes by which initial control over and, access to material resources and labor translates into resilience (vulnerability) and cumulative advantage in shock-affected contexts. However, this analysis will remain to some extent inductive and attempt to identify other salient factors that emerge in the data analysis.

This analysis will also place considerable emphasis on forms of so-called 'social capital' associated with inter-household economic relations—that is, the social relations that in part determine access to resources in agrarian settings. Such relationships are, of course, inextricably linked with the aforementioned processes of stratification. However, uses of the term social capital vary widely, and in many cases are unhelpfully broad. As Woolcock (2000) observes,

> Indiscriminate applications of social and other "capitals" are part of what Baron and Hannan disparagingly refer to as the recent emergence of "a plethora of capitals." Sociologists, they lament, "have begun referring to virtually every feature of social life as a form of capital." In the case of social capital, several theoretical and empirical weaknesses emerge as a result (Woolcock 2000: 155)

Given such tendencies, this dissertation this analysis proceeds without actually using the term social capital. Instead, it explores two more specific phenomena.[23] The first is the functioning of inter-household redistribution mechanisms within communities during periods of environmental and related economic stress.[24, 25] This phenomenon has been studied in existing research by scholars of African development, which has emphasized both the shock-mitigating effect of

[23] Admittedly, these foci exclude a number of important subjective factors and emotive relationships associated with community cohesion (Wisner 2009).

[24] One of the main limitations of this definition is that the geographic community may not adequately capture households' actually-existing social networks, which are likely to expand beyond a given community's boundaries (Janssens 2006 for review)

[25] Although the analysis of social capital (so defined) in this dissertation will draw upon qualitative data only, this definition could be reformulated to accommodate quantitative analysis in future research by, for example, defining it as the likelihood of inter-household transfers during periods of environmental and related economic stress.

these informal safety nets (or insurance systems) and the possibility that persistent shocks erode such systems (Berhanu 2011, Mogues 2006).

This analysis also focuses on social relationships that mediate access to, and control over labor and other resources. Here, the focus is on relationships that are not necessarily contingent upon the existence of a crisis or scarcity. Rather, I focus on relationships that form during such periods of stress but endure over longer periods of time, during which they affect households' ability to command labor and other resources from other actors. The focus on these two forms of what others have called social capital provides insight into the ways that social relationships may mediate the impact of shocks and be reformulated as a result of those events, with long-term implications for resource accumulation and related outcomes (e.g., agricultural production).

Vulnerability in Kejima

With these theoretical expectations in mind, I begin with an analysis of vulnerability and resilience in Kejima, as described by community members themselves. Throughout interviews and focus groups, respondents tended to discuss vulnerability and resilience as they relate to households and communities in smallholder contexts like Kejima. However, a number of respondents argued that no one was resilient in Kejima: all households in the community were vulnerable to shocks. These respondents tended to discuss vulnerability and resilience in terms of non-agrarian societies remote from Kejima. I briefly discuss these responses below, since they help to identify certain forms of vulnerability experienced by all community members. I then turn to responses focused on the Kejima context, which underline sources of difference in vulnerability within the community.

In the analysis that follows, I draw upon knowledge from interview respondents' descriptions of wealth strata in Kejima and classify respondents' wealth status in the following way: households with land holdings less than or equal to 0.25 hectares or less than 3 cows were considered to be in the lowest wealth stratum; households with between 0.26 and 0.99 hectares of land or 3-5 cows were considered in the middle wealth stratum; and households with 1.0 hectare or more of land or 6 or more cows were considered in the upper wealth stratum. Households whose land and cattle holdings met different thresholds were classified as belonging to the middle wealth stratum. For example, a household with 0.25 hectares of land and 3 cows would be considered to be in the middle wealth stratum. Further, if a respondent gave an ambiguous answer regarding either their land or livestock holdings (e.g. "I own some cows"), that datum was not considered in the classification. Using this system, 35.7% of interview respondents were classified as "low wealth"; 46.4% as "middle wealth"; and 17.8% as "upper wealth." The assets of focus group respondents were not recorded in transcripts or field notes, and as such these persons' wealth statuses were not classified.

Idealized constructs of vulnerability and resilience

Respondents that discussed vulnerability and resilience in idealized or decontextualized terms tended to believe there was a uniform absence of resilience in Kejima. As one male interview respondent (middle wealth stratum) explained, "We can't say that someone is resilient in our area because everybody needs help." These respondents suggested that resilience to environment shocks could only be realized among those whose social and economic status was not tired directly to agricultural production. They associated resilience with living in towns or cities, and having secure employment that was not contingent upon the rains, other people (who

are often also dependent upon environmental conditions), and other uncontrollable factors (e.g., government assistance). For example, one male respondent described resilience in terms of his hopes for his children, saying,

> …They will continue to finish their school, and I hope that they will start their business. Some of them may get office work. By that way, I hope that many of them will stay in the town. -Male respondent, low wealth stratum

Despite some complaints about corruption, government employment was a preferred non-agricultural livelihood for many households. This preference largely stems from its good pay, stability, and power. As one female focus group respondent explained,

> If [my children] become government officials they can have a good car, and…they will have a nice place to live in good towns… And they have their salary on time, and they can also help us when they get that salary. -Female focus group respondent

The emphasis on power and control—or at least predictability—in this and other responses likely reflected many respondents' powerlessness with respect to environmental conditions and other external factors, including the distribution on PSNP and other forms of aid that many households depend upon.[26] One female interview respondent explicitly linked government employment with obtaining recognition and resources by the government, saying,

> Even though the government is not looking [our for] our interest, I want my children to go and work for government. Because if they are there, they may recognize us here. -Female respondent, upper wealth stratum

Finally, a number of respondents mentioned car and motorbike ownership. One male focus group respondent described how his son might benefit from the ability to drive, saying,

> If a boy has a chance to get a driving license, he can go somewhere. He can drive and he can leave, and survive by himself. -Male focus group respondent

Cars and motorbikes were seen a marker of wealth but also, perhaps more importantly, mobility and thus the ability to escape the constraints of Kejima.

[26] This includes government fertilizer and seed subsidies, NGO projects, and private assistance from other community members.

These idealized and de-contextualized notions of resilience were based on the assumption that all households in Kejima are to some extent vulnerable. As such, these responses provide insight into many of the constraints faced by nearly all residents of Kejima. These constraints include powerlessness, unpredictable circumstances, and immobility, among others. Such factors undoubtedly contribute to vulnerability, but mainly vis-à-vis other communities rather than within Kejima. To understand differences in vulnerability among households in Kejima, responses that focused on Kejima and similar smallholder contexts provide more insightful.

Vulnerability and resilience in Kejima

This second type of response—that focused on households in Kejima or similar smallholder contexts—is ultimately more useful for identifying sources of heterogeneity among households in the community. One female focus group respondent recognized this herself, saying,

> There is no other thing that we can talk about that [resilient person] because in our case, there are no big business workers here, those who have a big shop, or those who have a car. There are no such people here. The people who are living in this area, they are just measured by their land, by their cow, by their goats and sheep. -Female focus group respondent

Indeed, livestock and land were perhaps the two most commonly mentioned and highly emphasized factors in descriptions of household vulnerability and resilience. In the pages below, I describe these and other factors that interview respondents and focus group participants associated with resilience (vulnerability). Here, it is worth emphasizing that the objectives of this chapter are purely descriptive: the relationship between many of these factors and vulnerability is not unidirectional, and many of these factors are undoubtedly correlated with other factors that contribute to vulnerability.

Livestock and other wealth

Given widespread reliance on on-farm agricultural production for food in Kejima, shocks that affect local agriculture had direct effects on households' own food production and other factors affecting access to food, including food prices and employment opportunities. The impetus to fill subsequent gaps between household food availability and nutritional demand was the main driver of household responses to shocks in this context. In other words, environmental shocks affect household and community outcomes via food insecurity.

Not surprisingly, many respondents emphasized that households with relatively large stores of easily liquidated wealth were less vulnerable to such shocks than others. These households could simply sell a portion of their livestock—albeit often at extremely low prices—and use the money to purchase food from the market. As one female focus group respondent put it,

> Those who are resilient people are those that have a good capacity to resist any shock when it comes to them by selling their cows… they have a large amount of resources which helps them to resist bad years, to resist bad situations, to resist bad years. -Female focus group respondent

Livestock is perhaps the most common source of such liquid wealth in the community, but it is not exclusively so. For example, one male interview respondent described how some households might also draw upon their natural resource bases, saying,

> People will sell their cows…and those who have a tree will sell the tree. If the rain is not good here, it may be good in some part of the country, and the crop in the market is coming from there... Those that have a tree, they sell that tree to be cut for the log, then they buy food from the market." -Male respondent, middle wealth stratum

In recent years, government-sponsored microcredit groups, savings groups, and a commercial bank in the nearest administrative capital (Dore) also provided opportunities for households to establish monetary savings. As a male interview respondent explained,

> The [resilient] one who has good access to land, big land…and the one who sends his children to school and those children become government officials. And the one who has a deposit in the bank because then he or she, when a problem comes, they can protect themselves from that problem" -Male respondent, middle wealth stratum

While nearly all households in Kejima had at least some livestock or savings, respondents emphasized that resilient households had sufficient resources such that they could be drawn upon for the duration of most crises without jeopardizing the household's long-term social and economic status. In contrast, vulnerable households often face the prospect of selling their last, or near-last head of livestock during a crisis. This would eliminate the possibility of regenerating their livestock holdings naturally (i.e., through births) and leave no resources to purchase agricultural inputs for the next growing season. One female focus group participant described these differences, saying,

> Some people they, they do not have the capacity to buy improved seed and fertilizer. The better off households, they have a cow, sheep, goat, something, and they take that to the market [to sell] and they buy some improved seed and fertilizer to plant. -Female focus group respondent

Together, these responses suggest that livestock and other forms of liquid wealth contribute to resilience by allowing households to remain food secure during years with poor crop production, while also maintaining the ability to recover and secure normal levels of food production in the aftermath of the shock.

Land

Respondents also placed considerable emphasis on land. This focus is also unsurprising given the centrality of land to agriculture. With respect to vulnerability and resilience, respondents suggested that land quality, size, and geographic distribution were salient factors. Each of these qualities of land affected the likelihood that a household: (1) had stored food or

monetary savings from selling surplus production during previous years; (2) realized a subsistence-level of agricultural production during years with poor rainfall; and/or (3) had access to relatively large quantities of mature (i.e., edible) *ensete*.

Land size was perhaps the most emphasized factor. This is clear in the responses quoted above. Other respondents also underlined the importance of land size by identifying specific ways that it contributed to vulnerability or resilience. For example, one male respondent explained that during the most recent years with poor rains (2011-2012), households with large landholdings were more likely to receive a sufficient absolute level of production than others. He said,

> In our case we have very small land, we didn't get any production. For those who have a bigger plot of land, they told us that they got very small production last year. -Male respondent, not ranked[27]

Simply put, households with large landholdings were likely to receive more absolute agricultural output during years with poor rainfall than those with small landholdings, despite substantial decreases relative to normal years. Assuming, for example, that rain failures led to an 80% reduction of output among all households, those with larger plots likely received more absolute output than others, and as such faced less food scarcity (all else equal). Moreover, households with larger landholdings were more likely to have obtained surplus production in good years, and thus have food in storage or monetary savings from selling that surplus production in the past.

One respondent suggested that without adequate crop production, wealth accumulation—in this example, via small businesses—was not possible. He said,

> Two things are very important. The crop production which is for food. Money for business… [But] only money does not change anything… Crop production is more important than…money…because if you have enough food in the house we don't [have to] buy any food from the market. -Male respondent, low wealth stratum

[27] This respondent was the deputy leader of one of the villages within Kejima, and responded in a key informant interview that did not include questions about his household's wealth.

Households with little land are more likely to live at the margins of their own food production and nutritional demand, with limited possibilities for savings under ideal conditions. In one extreme case in Kejima, an effectively landless household remained dependent upon wage labor and PSNP support on a year-to-year basis. Given the link between wealth (described above) and resilience, the ability of relatively large landholders to accumulate wealth is not trivial; nor, then, is the diminished ability to accumulate wealth during and after environmental shocks.

According to respondents, land size was also positively associated with households' ability or likelihood of diversifying crop production. Although households with landholdings of all sizes planted crops other than maize (the primary crop in Kejima), those with large landholdings were more likely to have devoted substantial amounts of land to these non-maize crops. As one male respondent explained,

> Those that have a small land, they also plant this false banana in some parts and the remaining part they sow maize, and in the remaining small part they also sow crops that mature very quickly, like potato and haricot bean… Everyone can do this, but the rich are doing more than that one because they have more land than the poor. -Male interview respondent, not ranked[28]

Another respondent, a female focus group participant, makes a similar observation with respect to *ensete*, which is particularly important given its relative drought resistance and cultural importance. She said,

> Some better off people even have false bananas for bad years. The poor do not have false banana in their garden because they have little land and they couldn't plant that false banana. Those who are better off, they plant better false banana every year. -Female focus group participant

Of course, the size of households' landholdings in Kejima was not an all-determining factor. In some instances, households owned or temporarily shared land outside of Kejima. Net

[28] This respondent was a community leader, and responded in a key informant interview that did not include questions about his household's wealth.

of landholding size, diversifying the geographic location of agricultural land had the potential to decrease the impact of rainfall deficits in Kejima (or the location of the other land). As in much of Ethiopia, microclimates vary markedly in the area surrounding Kejima. Thus even locations within walking distance of Kejima may have experienced rather different weather conditions than those in the community, with clear implications for crop production in those areas. As one male respondent explained,

> …I may get some production, not lose it all because I do have two or three lands to be harvested. If on some of my land I completely lose production, from some land I may get some production. -Male respondent, middle wealth stratum

Another farmer had a similar experience, which he described saying,

> The production on the land which is near to me [in Kejima] completely failed, but I have got some production from the land that is thirty minutes away from me because that area is a little bit colder and it conserves water. -Male interview respondent upper wealth stratum

In a final example, a householder with the capacity to share land (i.e., supply the seeds and fertilizer for another landholder) outside of Kejima experienced the effects of heterogeneous environmental conditions; but in this case, the crop planted in Kejima fared better than those planted in another location (Borecha *woreda*). As he said,

> The last year, the one which I share on Borecha doesn't give any production, it gave me little production… But we did get some production from here [Kejima] and that allowed us to survive. -Male respondent, middle wealth stratum

These examples demonstrate that geographic diversification of landholdings may have been positively associated with resilience to shocks in Kejima. Households that owned or controlled land outside of Kejima may have been less exposed to the rainfall deficits that affected the community. Of course, the opposite may hold true in years with normal rains in Kejima but adverse conditions in the location of other landholdings. Finally, it should be noted that most of the respondents that owned, or were able to share land outside of the community were wealthy.

This suggests that geographic diversification and household wealth may be positively correlated.[29]

Finally, as discussed in Chapter 2, respondents suggested that land quality was heterogeneous across the community. High (low) land quality may have contributed to resilience (vulnerability) by affecting previous years' production, and therefore the odds of having stored food, or maintained savings from surplus production in previous years. Land quality may have also affected the baseline, or normal production from which a year with poor rainfall deviates. Finally, it may also affect a given plot's sensitivity to environmental conditions. For example, one male respondent explained,

> In this area we all faced a food shortage because as you see it is up on the hill. When the rain stops for only two days, everything will dry here. If we were down in the lowland, some crops may resist the time until the rain comes. -Male respondent, not ranked

Together, these responses indicate that land size, quality, and geographic distribution were generally positively associated with resilience to environmental conditions in Kejima. These factors may have contributed to resilience through multiple mechanisms, including crop production, crop diversification, and wealth. Of course, these relationships are not causal. Many of the dimensions of land described above are correlated with other factors, and may be the product of historical processes of land acquisition and distribution.

Demographic composition

Vulnerability and resilience also varied by households' demographic composition—including household size and the age and gender of householders. For one, family size—here, determined mainly by the number of children—affects food and other resource demand within

[29] Other factors—such as geographically dispersed social relationships—may help explain the association between geographic diversification of landholdings and wealth.

households. For example, one female respondent suggested that despite her family's relatively large landholdings and livestock herds, they were nonetheless at risk because of their many children. She said,

> Yeah it looks like we are resilient, but because we have many children in the house, we are very much exposed to everything. -Female respondent, upper wealth stratum

Importantly, the number of children in a household may have also affected the distribution of vulnerability over longer periods of time via land transfers and inheritance. As one female focus group participant explained,

> The main difference is land size. Those who are better off have bigger land than those who are poor. And the other is the number of children. In one house…they may have five or seven, eight children. The father is dividing his land for those five or six children and so he remains with nothing. -Female focus group participant

This account underlines the way in which resilience and vulnerability were, in part determined historically—in this case, by households' demographic and economic histories[30]. It also demonstrates the ways in which the factors described in this section affected vulnerability and resilience through multiple, often intersecting pathways.

The discussion of demographics and land transfers brings up an additional link between demography and vulnerability (resilience): inter-generational differences. As male children formed their own households—and their fathers aged beyond their peak years of labor productivity—land was transferred from father to sons. This diminished fathers' landholdings. Although the men that inherited the land also presumably control less land than they enjoyed while remaining a part of their father's household, it is often the father's household that experienced the greatest losses—and increased vulnerability—because land is often transferred

[30] Here, it is important to emphasize the link between demographic and economic histories, since these are integrally linked. For example, households that can afford to send their children to Hawassa for school are less likely to have children who return to the village and make claims on land.

to multiple sons. Indeed, inter-generational transfers left some fathers dependent upon their sons with little guarantee of support. As one male respondent with such an experience explained,

> Before I distributed this last, I had a bigger plot. I got some production from there; it was enough for my family. But after I distributed all this land for my boys… the land which I own right now is very small… My [sons] were helping me at first… After they have many children they couldn't even afford food themselves. -Male respondent, low wealth stratum

In addition to losing much of their land, many of these older men were also too old to be viable workers in the local labor market. As the same respondent asked, "I am an old man, how can I work?" He also claimed to have little to eat. In such instances, the elderly were highly vulnerable.[31]

Given stark gender boundaries in Kejima—as in most places—female-headed households[32] also faced disproportionate levels of vulnerability. One female interview respondent[33]—a female householder herself—explained,

> Male-headed households and female-headed households are so very different. [The] male household head, he helps his house a lot, and he has a voice to be heard in the community. [The] female household head, she is struggling, everything is not successful for her. It's very difficult. She has no acceptance in the community as males have. A male household head, he can work on other's field on share or on contract. Females do not have such a capacity to work for other's field… Me, I can't sleep. I am just running here and there, struggling to bring up my children. Female-headed households and male-headed household are very different. Even in the community, it is very different. -Female interview respondent, low wealth stratum

This description highlights women's restriction from the wage labor market.[34] Unless female-headed households include working-age male youth, they are therefore unable to engage in perhaps the most important coping strategy available to low-wealth households. This is a major

[31] Children may have also experienced unique forms of vulnerability (resilience), but data about within-household inequalities (e.g., nutritional intake) were not collected or otherwise available for Kejima.
[32] Within this disadvantaged group, status may differ according to whether their spouse died or they were divorced. There were not sufficient observations to fully explore these differences in this study.
[33] This respondent lived in a village just beyond the boundary of Kejima, but her response still provides an accurate description of the challenges faced by female-headed households in the community.
[34] It should be added that women are also restricted from land sharing and other cooperative agricultural practices.

disadvantage. Of course, using male youth labor may also have significant long-term consequences; for example, it often comes at the expense of those youths' primary education.

The quote above also emphasizes the social and political marginalization of female-headed households, which often had important material effects. For example, one female respondent (a householder) explains her fears about losing PSNP support, saying,

> Yeah I fear that because I am female… No one is supporting me…if right now the retargeting comes, people are just pointing the finger to female-headed households first. If I was a male, they would fear that male. They don't want to point a finger to him. But because I am female, I think that if the [PSNP] retargeting comes they will just point finger at me first… I fear it. -Female respondent, low wealth stratum

Importantly, the association between fear or uncertainty and vulnerability was not limited to female householders. As one female interview respondent (in a male-headed household) stated,

> When something like the dry time happens, [the resilient person's] family passes that time without any fear… When I see my life, when drought time comes, I am afraid because I have many children who need food. And those who are resilient people have a small household… have a good land, a good production, a good cow. Whenever something comes, they don't fear. But right now we are fearing. -Female interview respondent, upper wealth stratum

This respondents suggests that vulnerability (resilience) is not merely an objective material state, but also an embodied way, or experience of living.

Social relationships

A number of respondents also associated resilience with maintaining respect in the community, and providing assistance to the poor, or those otherwise in need. Of course, the ability to provide assistance largely reflects the agricultural capacity of those identified as resilient. As one male respondent put it,

> [The resilient person] can live without any fear. And having false banana. When a drought time comes, he can consume that one also, and he can help other people with that false banana. -Male interview respondent, middle wealth stratum

In many cases, however, engaging in the community by assisting the poor appeared to be valued in its own right. For example, a male respondent said,

> The one who has a bigger land, the one who has a bigger cow, and bigger false banana [is resilient]. And the one who has enough food in his house, and the one who has extra money made by running a business. And the one who helps poor in his area. When the poor come to him, they get some food from him. Those people are considered resilient in our area. -Male respondent, middle wealth stratum

Relatedly, another respondent emphasized the importance of overall engagement, or having a voice in the community, saying,

> The one who [is resilient] has a big land…a good product, and [is] agreeing with people, agreeing. And the one whose voice is heard by the community, and the one who hears the other's voice. -Male respondent, upper wealth stratum

Resilience in Kejima clearly goes beyond simply having the capacity to assist other households. It also includes social engagement in the community, and the maintenance of both material and social relationships with other community members.

Entrepreneurialism

Finally, a number of respondents suggested that entrepreneurial skills or motivations might have helped some households cope with environmental stress better than others. As one female respondent stated,

> Few people are just, their lives are improving; but the others are remaining the same as before because people are not…thinking in other ways other than their land to change or to improve their life. When they…plant crops and when the rain stops, they become poor and poor. But those who are struggling on the land and doing some small businesses, those are improving themselves -Female interview respondent, upper wealth strata.

While households undoubtedly face structural constraints to small business and related activities, respondents also emphasize the importance of a particular mindset, which rich and poor alike

may have. In fact, one respondent suggested that this mindset might have its origins in previous struggles. In other words, crisis spurs innovation over the long run. He said,

> …Five or six years ago, people are getting hungry and, there was a problem. So some people migrated from here to towns to search for a job, and they learned…how to do some businesses there, and they came here again and started these small businesses… Learning about business like this came from the problem. Because of the problem, people are going to search for jobs for survival… Those who are better off farmers, who have a big land and bigger cattle, they do not know how to do a business. -Male respondent, middle wealth stratum

Such a sentiment was not expressed widely among other respondents, but it would be wrong to discount the importance of previous experiences and individual motivations. In a community where the gradations in wealth are indeed quite minimal, such idiosyncratic factors may have important consequences.[35]

Conclusion

This chapter has outlined a theoretical framework for conceptualizing vulnerability and social and economic inequality in Kejima, and presented the first analysis in the case study. Specifically, I analyzed the factors that residents of Kejima associated with vulnerability—or, alternatively, resilience—to environmental shocks and other challenges. Respondents tended to offer two types of descriptions: one that described resilience and vulnerability specifically in the context of Kejima or similar smallholder areas. The other description focused on households outside of agrarian settings, which reflected respondents' beliefs that all households in Kejima were highly vulnerable. Of course, even those that described resilience in smallholder settings did not necessarily believe that households in Kejima could be described as such. As one male respondent stated,

[35] In fact, one community leader in Kejima reported that he transitioned from being a PSNP recipient to one of the wealthiest households in Kejima through hard work and entrepreneurialism.

> When I see this area, there is no resilient person here. Because the resilient person is the one who has a bigger land, a bigger false banana, bigger, larger cows, and having enough food for his home…and the one who takes surplus food to the market for selling. The one who faces any problem. That person is not living around me. But the resilient person is like that. -Male respondent, middle wealth stratum

Nonetheless, the responses analyzed above identify a number of factors that were likely associated with vulnerability and resilience, and thus contributed to differences in households' responses to, and outcomes after the recent rainfall deficits. These include monetary and livestock wealth; the size, quality, and geographic distribution of landholdings; household size and composition; social relationships; and idiosyncratic characteristics such as entrepreneurialism. Of course, the objectives of this chapter were purely descriptive, and many of these factors are likely highly correlated with each other and may reflect vulnerability to previous shocks.

The next chapter (Chapter 4) builds upon this analysis by identifying strategies used by households in Kejima to cope with the effects of recent rainfall deficits, and analyzing the implications of these responses for inequality within the community. The following chapter (Chapter 5) then estimates changes in between-household asset and livestock inequality associated with the rainfall deficits, and models the household-level changes in livestock and asset holdings that underlies potential rainfall-related changes in inequality.

CHAPTER 4: RESPONSES TO RAINFALL DEFICITS AND IMPLICATIONS FOR INEQUALITY

Introduction

Existing research has identified a set of behaviors that are commonly observed among drought-affected populations. Examples include: changing dietary composition and levels of food consumption; altering crop and livestock management practices; receiving food or money transfers (government and private); taking money or food on credit; using wage labor and petty commodity production to earn money or food; selling livestock and other assets; and migrating, temporarily or permanently (Corbett 1988, De Waal 2005, Helgeson et al. 2013, Lawson and Kasirye 2013). Similar types and sequences of coping behaviors have been observed across multiple countries in sub-Saharan Africa. However, the diversity of social, economic, and agro-ecological contexts across the continent—and within many countries—makes it difficult to simply use previous research to formulate assumptions about how households cope to environmental stress. Maxwell and Caldwell's (2008) work suggests that a core set of short-term responses to food insecurity have been observed in multiple contexts, making broad comparisons of a basic set of indicators possible. While useful for many purposes, the universal CSI they propose here has a much narrower focus on short-term food insecurity than the current study. In fact, the author's explicitly note that their CSI does not account for asset sales and other similar coping behaviors not directly tied to food consumption

With this in mind, this chapter draws upon qualitative data from interviews and focus groups conducted between March and July 2013 to identify common household responses to recent rainfall deficits (2011-2012) in Kejima. Further, I consider the implications of these responses for multiple aspects of social and economic inequality in the aftermath of the crisis.

Responses to drought

As Corbett (1988) and De Wall (2005) clearly demonstrate, responses to food crises—in this case driven by drought-related crop failures—occur in multiple phases. The timing and sequence of responses is not necessarily linear: households may engage in certain activities at multiple times during a period of stress. Nor is the set of coping strategies consistent among households: different types of households engage in different activities, the timing and sequence of which often varies. The heterogeneity of household responses reflects differential vulnerability and in some cases, beliefs or ethos about what is socially acceptable or economically best.

In this section, I analyze qualitative data from individual interviews and focus groups to identify and describe household responses to the poor crop production and food insecurity associated with poor rains in 2011 and 2012.

Changing agricultural and dietary practices

As the rains and crop production faltered during the 2011 and 2012 agricultural growing seasons in Kejima, many households' first response was to attempt salvaging their production by replanting crops. This often occurred during a temporary period of what was perceived to be the start of "good rains." In most cases, replanting did not yield significant benefits. One male respondent from a poor household explained, "I tried to plant some haricot bean after the crop [maize] failed, but it also failed." A female respondent (low wealth stratum) also reported, "the rain stopped when we sowed the crop, the rain stopped and the crop dried out."

Some households—often, but not exclusively better-off households—had access to seed potatoes, which they planted in the middle of the growing season (i.e., the beginning of the *Kiremt* season*)* to supplement their relatively low maize production:

> When we saw that the maize was dried out, we tried to replant it but the time had already come. So we just started planting haricot bean and potato in the months of late August...but it dried out because the rain stopped for a short period of time. Then we didn't get anything. -Male interview respondent, upper wealth stratum

Replanting did yield benefits in some cases. For example, at least one household's potato crops fared somewhat better than their maize and beans. These potatoes provided an important source of food during the prolonged hungry seasons:

> …We faced a food shortage…and we started to consume that potato… Even though crops—maize and other crops—failed, the potatoes did not fail as much. You could get some small amount of production from it. -Male respondent, middle wealth stratum

Clearly, such potato-planting households experienced a shift in the proportion of potatoes in their diet.

Although potato planting was relatively rare (see Chapter 3), most households in Kejima experienced other changes in the composition of their diet—largely in the form of increased *ensete* (false banana) consumption. The reason for increased *ensete* consumption differed among richer and poorer households. For relatively wealthy households, large plots of mature *ensete*—combined with stored surpluses of dried maize from the previous year—provided sufficient amounts of food such that they could avoid using savings to purchase food from the market.

As one of the wealthiest householders in the community explained,

> I didn't go to the market to buy other food because I had this false banana, which is alright for food. I also had maize in my storage. My family consumed that, and by that way we coped. -Male interview respondent, upper wealth stratum

For the poorest households in Kejima, the *ensete* they consumed often came from other, better-off households. Although many poor households grew *ensete* plants in their own gardens, these

plots were often small and thus more likely to hold immature and inedible plants. In some cases, *ensete* was simply given to the poorest households by the better off. For example, one male focus group respondent explained, "others who have this *ensete*, they cut the bad part and give it to the poorest of the poor." In many cases, however, *ensete* was used as payment for labor, or was given with the expectation of work or repayment in the future. For example, one male respondent explained,

> They just call some poor people and give them that false banana, and say, 'please take this one and when you pass this bad time you will pay for me next time'
> -Male interview respondent, middle wealth stratum

In another case, a female head of household (low wealth stratum) received *ensete* as payment for work. She explained, "Because I am a woman, I just prepared false banana for them. They gave me half of it sometimes." In other cases, *ensete* and other foods were transferred with conditions attached—mainly, future labor or repayment. One respondent described his experience, saying,

> Some of our family members helped me last year… They gave me…some maize and some false banana. *[Q: And did you have to do anything in return?]* Those who helped me, they own land in many different areas…so when they went to those other areas to work on that land, I just helped them by working [on their land] here… If they go there, they will stay a long time, and they tell me that you just please help us and prepare our land here [in Kejima] -Male interview respondent, middle wealth stratum

This link between labor, food, and other forms of assistance is important, and given further attention below.

Of course, most households did not simply change the composition of their food intake. The size and frequency of their meals also decreased markedly. As one person explained in a focus group,

> In some houses people may eat their dinner, but no breakfast. If they eat their breakfast, there is no lunch. Still now. Until this crop is harvested, the problem will continue. -Female focus group participant

The plight of the poorest households in Kejima is particularly striking. As one, nearly landless male respondent described,

> Right now I am working for food to take…for my child because sometimes my child feels hungry. Even sometimes in the nighttime she feels very hungry. We are, me and my wife, we are bigger people and we can resist that hunger -Male interview respondent, low wealth stratum

In contrast, the impact of the rainfall deficit among the wealthiest households in Kejima was limited mainly to their ability to sell surplus production on the market. As the head of one of these households explained,

> The frequency [of meals] and the meal size also, is the same [between good and bad years]. If there was good production, I would have sold some production to the market, but I didn't sell last year. -Male interview respondent, upper wealth stratum

Clearly, food shortages and hunger were distributed unequally among households in Kejima.

Responses to hunger

For many households in Kejima, the gap between food production and consumption needs was unsustainable during much of the two drought-affected years. Many households received temporary respite during harvest periods when at least some output was secured. Since output was far below normal, however, many households depleted their stores rapidly, increasing the impetus to access food outside of the household and in many cases leading to a longer and more severe hungry seasons than normal.

The qualitative data discussed in this chapter suggests that households in Kejima coped using five behaviors or resources: (1) increasing petty commodity production and sales; (2) selling livestock; (3) utilizing government support; (4) travelling or temporarily moving to less-affected communities; and (5) securing food through labor and debt. Nearly all households in Kejima were involved in more than one of these activities. The description of one woman's

activities is emblematic of how households—particularly the poorest households—"ran here and there" to survive, as many respondents put it. She said,

> Sometimes we eat, sometimes we leave [to work], sometimes we buy from the market, sometimes we just get some food from the others who have food. We spend [the hungry period] that way. -Female interview respondent, low wealth stratum

On the other end of the wealth spectrum, wealthier households often redistributed resources to other households through various mechanisms, while also dealing with constraints of their own. One respondent—perhaps the wealthiest man in Kejima—explained that over the past year,

> [I] gave two people two quintiles of maize for free, one each. And I remember that some villagers…I gave them daily food. And I gave some people credit in cash… I tried to add some [other] people also but I couldn't do so because it was a bad year for me even -Male interview respondent, upper wealth stratum

This section describes these responses.

Petty commodity production, sales, and trading

Many households engaged in income generating activities, such as producing and/or trading of petty commodities (e.g., *ensete* byproducts [*kocho*], maize meal, butter), cattle brokering, local transportation (e.g., donkey taxi), and water portage. Numerous residents of Kejima participated in at least some of these activities during normal times, but the imperative to obtain even petty profits to purchase food increased markedly in response to the poor crop output. Households also had more time to engage in these activities since their fields required less labor after the crops failed. In short, relative to a year with normal crop production, more households—and more members of households—engaged in "small businesses" to obtain *birr* and purchase food in the market during this crisis.

There are three particularly important aspects of small business activities in Kejima. For one, both men and women contributed to the household by working small businesses. One man explained,

> I just worked different types of things to make my family survive… Not only me, my wife also worked for other people [by preparing false banana]. She brought some food for us. -Male interview respondent, middle wealth stratum

However, the particular types of activities that men and women engaged in were often restricted by gender norms. As a female focus group participant explained,

> Some are just doing some small businesses. Men are going to the market and they are working as a broker in the cattle market. Some women are just doing a small business like butter and [false] bananas and salt. Selling that to the market and buying some [food] for the children. -Female focus group participant

Notably, both men and women engaged in maize sales and arbitrage. Children were often involved as well. One relatively wealthy female interview respondent said,

> The girls are just working the same thing which I am working [making butter and processing false banana]. Boys are working different things, like they are transporting people by local horse, horse—local transportation which you have seen in the road. They are working like that. -Female interview respondent, upper wealth stratum

This response suggests that children are subject to gender norms as well.

Second, both wealthy and poor households used these small businesses as part of their coping strategies. As one female interview respondent from the upper wealth stratum put it,

> Yeah I started [a small business] because the last year was very bad. I started to get some extra money and get some food from the market. But now it is very sweet for me -Female interview respondent, upper wealth stratum

A female interview respondent from the middle wealth stratum also engaged in a small business, but described it in slightly different terms, saying,

> [The past] two years were very much a problem and because…I am working a small business, that helped my family to survive. We didn't have anything to eat during these two years… Unless that business, we couldn't survive. -Female interview respondent, middle wealth stratum

The difference in how respondents describe their small businesses is associated with the third important, albeit already well-established point with respect to these activities: the motivation for, and consequences of these businesses often varied markedly between better-off and poor households (Barrett et al. 2001). Take, for instance, the account of a male interview respondent from a very poor household:

> Last year I just, I did business by buying some maize from those who have a bigger land. They had some production last year even though the year is bad. I would buy some maize from them and then take it to the market to sell. After I get some profit from that, I just exchange that profit for my family's food…[*Q: Where do you get the money from to buy the maize before you sold it?*] I borrowed that money from somebody else…I paid by interest… [My wife] is also borrowing some money from villagers who have money and after we get some profit, we pay them the interest and the profit will go for our children's milk and for food. -Male interview respondent, low wealth stratum

This household not only relied upon others for the maize they attempt to re-sell for profit, but it also purchased that maize using a loan with interest attached. This undoubtedly constrained their ability to benefit from the small business, and put them at risk of long-term indebtedness in the event that they could not earn a profit. That risk was not trivial: with so many others engaged in the same or similar activities, the market was often flooded. Wealthier households that could self-finance and/or self-supply such profit-seeking activities faced markedly lower risks.

Livestock sales

Among households with livestock—especially those with relatively large livestock holdings—livestock sales are an extremely common means of obtaining *birr* to purchase food from the market. One community leader suggested that these sales were not just common, but necessary during recent periods of stress,

> There are no alternatives other than selling animals. People sometimes, those who have a little bit of money, they run here and there, making some little business, some small business, and survive like that one. Those that do not have such kind of money, no such kind of cows and animals, they stay in their home and ask god to help them survive. -Male interview respondent, not ranked

Livestock sales came at an obvious price, however, in terms of both liquidated wealth and the likely opportunity cost of selling livestock during a period of stress, when prices usually plummet (Barrett et al. 2003). Moreover, since prices during recovery periods typically increase dramatically, households that are able to find other sources of money to purchase food (e.g., via loans) may stand to profit by delaying livestock sales until market conditions change. With these potential costs in mind, it is not necessarily surprising that livestock sales often occurred at a considerable delay from the onset of hardship. Another community leader described the timing of livestock sales, saying,

> It is not as soon as the rain stops or crop fails… they think that there may be some rain coming and this crop may survive and give some production. If they do not have such, they lose a hope and then they start to sell their cows. -Male respondent, middle wealth stratum

Interview data suggest that livestock sales occurred among most households, with the exception of those without sellable livestock or with unusually large landholdings and stored surplus from the previous year(s) harvest. For example, a male respondent from the lowest wealth stratum explained that even he sold cows. He said,

> I sold two cows during this hungry period because my land is very small and I don't have good production. During the hungry period I sold two of the little cows which this bigger cow gave birth to. -Male interview respondent, low wealth stratum

Likewise, a respondent from a somewhat wealthier household also described selling his cattle, saying,

> Two years ago I had five cows, but because of the drought—and since I am sending my children to school—I sold three of them… I had no problems because I sold some cows

> to fill that gap and passed last year without any shortage. -Male interview respondent, middle wealth stratum

Here, it is worth underlining that this respondent's concern for his children's education contributed to the imperative for selling his livestock. This contrasts with the survival-oriented motivation expressed by the respondent from households in the poorest wealth stratum.

Among those with the capacity (and imperative) to sell livestock, these sales were often preferred relative to taking money or food on a credit basis. For example, one respondent said,

> If you take some food from the other people as a loan, they ask you to work more than what you originally got from them. So we don't want to do that. I simply sell my cows or my sheep or goat, and then I buy from the market. -Female interview respondent, upper wealth stratum

This suggests that at least some households' responses were shaped by a desire to maintain autonomy and independence with respect to one's labor power and future income. Considering that, as noted above, rapidly increasing prices during the recovery period offer the potential for considerable economic gain—likely offsetting the cost of any interest on loans—some may find the apparent preference for selling livestock over obtaining loans puzzling. However, such a perspective assumes a robust credit market and reliable knowledge of interest rates and future livestock prices. Further, it appears that many respondents placed considerable importance on maintaining autonomy and avoiding potential stigmas associated with borrowing from other community members.[36] The consequences of labor, lending, and borrowing are discussed in the final part of this section.

[36] It is also possible that the high frequency of reported livestock sales was in part driven by measurement error. Many households may have been reluctant to admit livestock deaths—a potential indicator of poor husbandry skills—and therefore reported deaths as sales.

Government support

Since many households in Kejima were PSNP beneficiaries (see Chapter 3 for description of PSNP), the program's food and money transfers were an important factor in beneficiary households' coping strategies. The program also affected economic relations between beneficiary and non-beneficiary households. Respondents described using PSNP cash transfers in a number of ways during this period of stress. Foremost, households used the cash to purchase food. For example, one beneficiary explained how PSNP was helping his household to survive the prolonged hungry period, saying,

> There is none of last year's production in my house right now…so right now I am just buying food from the market by the money which I am getting from the PSNP -Male interview respondent, low wealth stratum

Another household used the PSNP funds to purchase improved seeds and fertilizer for the growing season after the two rainfall deficit years (i.e., the year data were collected), saying,

> This year I didn't spend that PSNP money on other things. I just deposited that to buy the improved seed and fertilizer because last year I didn't get any production from my fields. -Female interview respondent, low wealth stratum

Such households would likely have sold some of their production to purchase these inputs in previous, more successful years; but without such production PSNP support provided an important resource to fill the gap. In the absence of PSNP support, this household (and others) would not have been able to purchase these inputs in the absence of loans or other income sources and, by extension, would have likely experienced diminished agricultural productivity during the subsequent growing season.

Finally, a number of respondents explained that PSNP funds were often used to repay debts that were incurred to purchase food from the market in months prior to the cash transfer. One respondent (middle wealth stratum) who had served as a moneylender explained, "Some of

them worked on the fields of other people, and they paid me back. Some of them paid me back when they get PSNP." One of the same community leaders cited above also described the connection between PSNP and debt in Kejima, saying,

> Even those who are PSNP beneficiaries, poor PSNP beneficiaries… they take some flour, some food from the market, from the shop for the sake of their family. When the [PSNP] payment comes from the woreda, those who have lent that food will stand by there and take the money away from them. And that poor household will go empty handed to his home and tomorrow he comes back and asks for some credit, some food credit. That is why some people are still poor. -Male respondent, middle wealth stratum

This is an important observation and if generalizable, suggests that a substantial proportion of PSNP funds may be diverted to moneylenders as debt and interest repayment. The use of PSNP funds for such repayment may be preferable to prolonged indebtedness, or other means of repayment with potentially negative consequences (e.g., selling productive assets to repay a loan). However, in such cases, PSNP may still be contributing to increased wealth among non-target households whose loans could be rendered unnecessary with rather minimal changes to the timing of PSNP transfers. Few proponents of the PSNP program would suggest that this is an ideal use of Ethiopian government and international donor funds.[37] Importantly, a number of these debts were incurred because PSNP transfers were delayed, and beneficiaries could not fill the gap in the rather short period of time between when the transfers were expected and when they actually occurred. One beneficiary explained,

> If god closes the sky, what can we do? We don't have any capacity to protect our crop. Only god protects it… I didn't set up any strategy other than PSNP… PSNP paid us some cash and brings us food. When [the PSNP payment was] late, I was working for other people, just working at their house. By that way I get some money from them, and I bought food from the market. -Male respondent, low wealth stratum

Clearly, unpredictability and the broader institutional context in which environmental shocks occur are important.

[37] To my knowledge, the linkages between PSNP transfers and debt relations have not been explored in existing research.

In addition to the usual PSNP support, the Ethiopian government intervened in two additional ways during the recent crisis in Kejima. First, female focus group respondents reported that some "powder"—a supplemental feeding formula—was delivered for malnourished children. Second, prior to the growing season in which the interviews took place (i.e., after the two years of rainfall deficits), the government allowed farmers to purchase fertilizer and seeds in two installments, rather than a single upfront payment. Specifically, farmers were permitted to pay only 50% of the prevailing price at the time of pick-up, and maintain an obligation to pay the remaining 50% without interest after the harvest. At that time, households would more likely to have *birr* from crop sales, and thus not have to sacrifice food consumption to pay for their inputs. This also reduced pressure to liquidate assets or take out loans to purchase agricultural inputs among some households.

A number of respondents believed that this program had an extremely positive impact on the community since so many households had depleted their savings to cope with the previous years' crop failures. However, a non-negligible number of households were still unable to purchase these inputs. As one female focus group respondent explained,

> As you see that the government has helped with fifty percent [of up-front fertilizer and seed costs]. But this fifty percent… did not reach everyone. The poor don't have capacity to pay even that fifty percent, so they did not get that fertilizer [this year]. They simply plant their crops without fertilizer on their land. -Female focus group respondent

This again underlines the importance of institutional context and the uneven impact of particular interventions within the community.

Mobility and migration

The coping strategies that many households employed often involved daily mobility beyond the community's spatial boundaries. However, migration—even if defined to include

only temporary changes of residence—was rarely a part of households' coping strategies.[38] The most common use of spatial mobility to cope with the crisis involved individuals travelling to work for wealthy households in other communities where agricultural production had been better, if only slightly so. One male focus group participant explained, "Others migrate from this area to another area where there are rich people. They help the rich and they get something to eat." Here, however, the term "migration" is used to describe only very temporary mobility. One of these "migrants" described this herself, saying,

> We even finished the false banana which were in our garden… Last year just god has helped us pass the year. Sometimes I worked for some people to get some food… I didn't work here in my village, I went to the other village called Wurfa… [*Q: Why did you work in Wurfa instead of here?]* The people who are living in this area are at the same level [as me], but rich people are living in Wurfa. The bigger landowners are living there, so we went there and worked for them…they have got good production… When I go there searching for work, I went to some people I knew first. After I worked for them, they just introduced me to other people -Female respondent, low wealth stratum

In this case, the destination (Wurfa) was located within the same *woreda* as Kejima, and for the respondent, close enough to walk to in the morning and return home at night. A number of Kejima residents took advantage of wealth differentials and micro-climatic variation within the *woreda* by moving back and forth between other communities for work. However, no household reported having members worked outside of the *kebele* as part of a coping strategy.[39]

The lack of longer-distance migration is notable. It may reflect the widespread lack of resources needed to pay the upfront costs for migration, or the lack of known labor opportunities outside of the area surrounding the community. Anecdotal evidence suggests that nearby urban labor markets (e.g., in Hawassa) are already saturated with low-skill workers. Additionally, there may be significant cultural and linguistic barriers to migration. For example, the region of

[38] Seasonal migration to a neighboring *woreda*, Borecha, was common among some households, normal and drought years alike.
[39] Recalling that a *kebele* is a sub-county (U.S.) equivalent, one can safely assume that within-*kebele* mobility was temporary (e.g., day labor).

Oromiya—home of predominately Oromo speakers—surrounds much of the area to the north and west of Kejima. Further, many residents of relatively nearby Hawassa speak the national language, Amharic. Since few if any residents of Kejima speak these languages conversationally, these ethno-linguistic boundaries may serve as effective impediments to migration. The lack of longer-distance migration is also consistent with some (not all) of the existing research on environment-related migration that has found short-distance mobility to be a common response to environmental change (e.g., Gray 2009, Massey et al. 2010).

Labor and debt

Paid labor was one of the most important sources of food, and money for food among households facing food insecurity in Kejima. This was particularly true for those with relatively small livestock herds or limited to nonexistent savings. One female focus group participant put the role of wage labor in the context of other possible responses, saying,

> Those who have a cow, they take that cow to the market, sell it, and serve their family. Some do not have a cow, and they go to some area and work some small business and bring some money to their family. Those, those who do not even have such capacity, they also work for the better-off people. By those ways, people struggle and pass that year. - Female focus group participant

Like the petty commodity production and trade described earlier, both men and women engaged in labor, but their particular tasks were highly gendered. Manual farm labor was the exclusive domain of men, while only women prepared food and engaged in other household tasks for their employers. There were no known exceptions to these norms among the persons I interviewed. Importantly, female-headed households could not benefit from wage labor on other households' farms unless they have a male son of working age. Household's coping strategies were therefore, in part, affected by age and gender composition.

Two types of agreements predominate in labor market in Kejima. In one arrangement—simple wage labor—an individual worked for another household and was paid in cash wages or food, with no further obligations among either party. One worker explained how wage labor fit into his household's strategy, saying,

> We went to the other people, to better off people. We worked for them. We got some food from some of them, or some money from some of them and bought food from the market. We passed that way… We worked as daily laborers…we don't owe anything [after that]. -Male interview respondent, middle wealth stratum

In some instances, paid labor may have been used to legitimize resource redistribution from better off to poor households during periods of stress. At least once during the data collection period, a group of men worked together plowing and planting seeds on a single field. Although every member of this group was set to receive a meal in appreciation for their work, only the poorest of the workers received additional wages. The landowner's better-off neighbors were performing identical tasks as the poor wage laborers, but without pay.

In the other common labor arrangement, an individual received food or money from another household during a time of need. The recipient was then obligated to work for that household at some later time when the patron household needed labor—typically starting the following planting and/or weeding season. During a break in such debt-fulfilling work, a respondent explained,

> I am just working for that person [who gave me food], even right now. Because I got some food from him last year, right now I am working for him by just pulling the bulls [to plow] and sowing the seed. After work, this afternoon, he will also give me some maize. I will take that maize to my house. -Male interview respondent, low wealth stratum

In this case, the respondent was not only working to repay his debt, he was also receiving food on a daily basis while working. While this may appear trivial in some respects, it is also indicative of the ambiguity that characterized many of the relationships between laborers and

their employers in this second type of labor arrangement (i.e., labor as repayment). Such agreements are simple on the face of it: those who received food or money at one time must work for the lender at a later time when labor is needed. However, the lines between paying back a debt, engaging in simple wage labor, and being exploited—in the sense of being obligated to work for below-market wages—was ambiguous in many situations. For example, when the worker quoted above was receiving food as he worked, was he working for that food, working to repay the food he received last year, or both? In other cases, the extent to which workers were obligated or expected to work for those who had lent them food or money after that initial debt had been repaid was unclear. Such ambiguity may have provided better-off households with opportunities to improve their immediate and future position in the local labor market—or reinforce an already advantageous position.

Interviews yielded evidence that interest—both monetary and in the form of labor—was often charged among households in Kejima. Although no respondent admitted to personally charging interest or demanding labor from those to whom they had given transfer (free food or money), nearly all respondents privately identified other community members that have. This is unsurprising given the stigma around interest in Kejima. As one male community leader explained,

> Such cases have happened… For example, the one who gives thirty birr per day to work on their plot of land reduces that wage to ten. And the poor do not have any chance or any alternative… Even some rich households may give a crop credit in-kind, like one quintile of a crop. If it is 600 birr in the market, he will give the crop to the poor man and make him pay back 1200 birr. If that poor man—in the coming year, in the next season—cannot pay that money the rich man will take his land from him. -Male interview respondent, not ranked

Another community leader offered a similar description, saying,

> Those that have the food in their house, if he gives [a hungry person] one quintile of maize, he asks two extra quintiles of maize in the next season. If he gives him 100 birr,

> he asks for 100 extra birr in the next season. By that way, they take advantage of this bad season. -Male interview respondent, middle wealth stratum

A respondent explained that some of the people who gave food or money during the recent food shortage felt entitled to be repaid with interest or additional work. He said,

> They need something in return. That is in the interest of everybody… if they do not fear god. That is why they ask them to pay interest and to work on their land… -Male interview respondent, middle wealth stratum

Notably, this respondent—who was identified by other households as an interest-charging moneylender—claimed that he was a "god-fearing" man and neither charged interest nor expected those to whom he lent money to work for him the following growing season. He said,

> I didn't ask them to help me. I simply gave them credit and they returned my money to me… If I asked them, 'please help me with this' they would help me, I know that. But still I didn't ask them for any help.

Nonetheless, he ultimately benefitted from their labor:

> There are some people who came and they said, 'you did a good thing for me last year and I would like to thank you. Not only thank you, I would like to help you.' When I was constructing this house, from the beginning up to the end, they helped me to construct this house.

At the very least, the initial relationships this respondent developed by providing loans and food transfers connected him with an accessible supply of voluntary unpaid labor. Likely, however, he also secured some degree of command over the labor of his beneficiaries through these relationships. Other better-off households that had recently loaned food and/or money describe similar situations. For example,

> I gave two people two quintiles of maize for free, one each. And I remember that I gave some villagers daily food, and I gave some people cash on credit. They bought food from the market for their family and right now they are helping me on my field… The food I gave was for free. I don't complain to them if them come to work or not. But from among those [that I gave food], some came and worked for money again this year. I gave them food for free last year, and this year they came and worked for me and took some money also. I didn't force them to work for me, those who took food for free. But those

> that took cash for the credit, they must work my field. -Male interview respondent, upper wealth stratum

One interpretation of these accounts is that by providing food or money during a period of stress or crisis, households with the resources to lend or give away food or money were able to position themselves to mobilize low-wage labor in subsequent times when it was needed, and would provide them with advantages relative to other households. Although the employers often reported paying their workers in cash or food during these subsequent periods of work, significant reporting bias is likely given the abovementioned stigmas against forms of interest in Kejima. In instances where food or monetary wages are indeed paid, they may often be less than they would have had to pay in the absence of previous loans or transfers.

The ability to pay discounted wages was particularly important for households after failed or low-output harvests, when even the materially best-off households in Kejima were often under considerable economic stress. As one employer put it,

> It's true that I didn't pay a good wage for laborers this year because last year the drought has affected me also…. I don't think that I will hire more people this year for weeding. I will try my best to weed my land by my own and with my wife. -Male interview respondent, middle wealth stratum

In some cases, households hired labor and paid wages only in food. As one poor male laborer explained,

> Last year I didn't work for money, only food. Because the crop had failed, people were not interested to give you a wage to work on their field because they don't like to pay money. -Male interview respondent, low wealth stratum

By not having to pay full wages, these better-off households may have been able to maintain their status and position as patrons (see next section), while avoiding the further cuts to their existing stores of wealth and food that would have been needed to pay full wages. Alternatively, discounted wages may have allowed households to avoid self-supplying the extra labor needed to

tend to their crops without hired labor or, if the latter was not possible, experiencing declines in agricultural productivity resulting from insufficient labor supply.

The ability to access non-household labor is not inconsequential. Many respondents believed that labor access has significant consequences for agricultural productivity. As one male respondent had access to labor put it,

> If there were not people working on the field for me, my production would decrease because of the weeds. The weeds are just like a parasite, and will take everything from the crop and lower production. Because I am the only person who is working on the field from my house—the boys are in their school—it is just important that the hired people work on my field. -Male respondent, middle wealth stratum

The negative consequences of these arrangements for laborers are clear.[40] Moreover, the bargaining power of labor in general was diminished during this recent period of stress—something that at least one better-off household was explicitly aware of. He said,

> Yeah, [I am paying] lower [wages] than last year. And before last year, I paid more than last year… Because of the drought I don't have more money to pay them… The number of people searching for jobs this year is so many compared to last year and before last year… It is…the case that we are reducing the amount of money which we are going to pay them because there are so many laborers available. -Male respondent, middle wealth stratum.

In this instance, one of the consequences of the drought was to increase the supply of labor and, in step, increase the ability of those with capital and surplus food to exploit labor and increase agricultural productivity on their own farms. While exploitation likely contributed to stagnating or declining material wellbeing among laborers, increased agricultural productivity often had positive implications for households' future wealth and food security.

[40] When considering the plight of poor wage laborers during this period, it worth reiterating that many of households are PSNP beneficiaries who often lose part or some of their PSNP cash transfers to moneylenders.

Coping strategies and social and economic mobility in Kejima

This analysis demonstrates that households in Kejima coped with the recent rainfall deficits and associated food crisis in a number of ways. With varying degrees of success, households attempted to re-plant crops and salvage as much agricultural production as possible. Then, as food insecurity set in across the community, households variously engaged in other activities including: (1) increasing petty commodity production and sales; (2) selling livestock; (3) utilizing government support; (4) traveling to work in less-affected communities on a daily basis; and (5) securing food through labor and debt.

While the exact set and sequence of coping behaviors varied among households, the qualitative evidence discussed above suggests that household coping strategies varied systematically between wealth strata. Importantly, households' coping behaviors did not simply affect their short-term outcomes during the crisis, but also had implications for future social and economic mobility. This section explicates the link between particular household coping strategies and cumulative advantage and disadvantage in Kejima.

Reproducing extreme poverty

With respect to labor, households that received food or money with spoken or unspoken obligations to the lender often lost a significant degree of control over their labor power. At a minimum, these persons experienced diminished bargaining power with respect to their wages. Alternatively, households that were able to give or lend money or food to others often emerged from the crisis better positioned to command low-wage or even wage-free labor. The ability of

relatively wealthy households to access discounted labor (through multiple means[41]) may have had significant consequences for their agricultural productivity in subsequent growing seasons. It allowed some households to acquire the labor needed to maximize the potential of their agricultural plots without sacrificing as much wealth as would have been necessary to pay higher wages; or alternatively, having to sacrifice future agricultural production by not hiring labor.

Households in the upper wealth strata appeared to be emerging from the years of rainfall deficit with power vis-à-vis labor that would enhance their ability to recover from the drought and accumulate wealth into the future. On the other hand, many poor households remained formally or informally obligated to work for others. To be sure, the food and monetary transfers, loans, and wages they received provided critical nutritional and economic support. In many cases, however, the exploitative relationships formed—or reinforced—through these loans and transfers contributed to forms of cumulative disadvantage and the reproduction of poverty and food insecurity.

Such patron-client relationships have received considerable attention among development scholars working in a wide range of contexts. This work suggests that, historically, ties between patrons and clients have been characterized by varying degrees of oppressiveness. That is, one might consider these ties along a continuum with an extremely oppressive form of patronage on one side (e.g., slavery) and on the other, an effective "moral economy" or system of mutual insurance against income fluctuations (for the client) and labor shortages (for the patron) (Platteau 1995, Scott 1977). According to Platteau (1995), a given patron-client system's place on this continuum is largely determined by the extent of patrons' rights and the degree of asymmetry in the power to terminate these relationships. These factors hinge on a set of

[41] The ability to command such labor was not necessarily limited to households that had given or lent money or food during previous times. As the interviews cited above suggest, overall local labor supply increased and wages decreased after the rainfall deficits.

institutional factors, including the labor market conditions for unskilled workers; the extent of off-farm economic opportunities for the rural elite; and the skills and responsibility requirements for on-farm labor. Kejima residents in both patron and client positions face limited economic opportunities outside of the local agricultural sector. While potential clients have limited opportunities outside of the few potential patrons in Kejima and surrounding communities, persons in patronage positions also face extremely limited economic opportunities beyond their agricultural production. This suggests that, according to Platteau's framework, the relationships observed here are less oppressive than other systems observed throughout history (e.g., chattel slavery, feudalism). Of course, the potentially negative consequences for clients' long-term economic trajectories may still be non-trivial relative to counterfactual situations in which these persons have access to other more remunerative economic opportunities and less costly insurance systems. Such alternatives—both of which are common objectives of NGO programming—would arguably provide the worst-off households with better odds of upward mobility in shock-affected areas.

Indeed, many of the coping strategies employed by poor households also reduced their longer-term capacity to engage in activities with the potential to increase their upward mobility. For example, at least one poor household had been previously able to accumulate enough savings to share land with a relatively land-rich household. By paying for fertilizer and seed, that poor household was able to effectively increase the amount of land under its control. However, the poor rains stymied production, resulting in a failed investment and preventing additional sharing into the foreseeable future. As a respondent from that household explained,

> Last year I worked on a share, but because the failure of the rain I didn't get any production from that one… [In the share] seed and fertilizer was from me… But I just, I lost everything… [*Q: Why aren't you sharing this year?]*…I feared if I do the same thing

> this year, if the same thing happens, I will lose everything this year also. -Male interview respondent, low wealth stratum

Likewise, diminished savings and increased debt burdens prevented some households from engaging in livestock fattening schemes (also see Chapter 2), which are a common means of attempting to climb the economic ladder in Kejima. A respondent explains how such strategies may work, saying,

> Three years ago, I had six, seven cows. Right now, thanks to god, I think it is more than ten… As you saw that I have many goats, I sell some of them and I buy some cows. I sell some goats year to year and I buy cows. -Male interview respondent, upper wealth stratum

Many poor households also viewed this as a means of achieving upward economic mobility. For example, one male respondent said,

> If I get enough money, I will fatten a sheep and goat… After I fatten these sheep and goat and sell them at the market, I will get extra money that helps me to buy some cows. -Male respondent, low wealth stratum

Given poor households' limited savings, the viability of such fattening operations was particularly contingent upon the success of the harvest. Wealth accumulation was a distant aspiration in the aftermath of failed harvests. In contrast, one male respondent (middle wealth stratum) from a PSNP beneficiary household explained, "If the year is good and if the crops, if the crop is good I will use the PSNP money to buy some small cows for tomorrow." Periods of environment stress not only affect households' short-term welfare, but also their ability to engage in strategies to improve their long-term chances of upward economic mobility.

<u>Diminished advantages among upper-stratum households</u>

Although I have identified a number of ways in which relatively wealthy households emerged from the crisis in advantageous positions, certain advantages that these households

enjoyed in prior years may have been diminished after years with poor rains and crop production. For example, households that were able to operate small businesses may have experienced losses or been forced to use their earnings for food rather than savings. One female respondent explained,

> During [the rainfall shortage]…your business will come down, fall down, because you just have to exchange your money for food for the family. Your profit will go to the food. Everything will go to the food because if the rain is not there, there is no production from the field. So our business will come down and anything we will get from the market, we just change that money to the food for family, for children. And, as you can see, these children need exercise book, pen, clothes, when they are going to school. That's why my business is not becoming big in the very need future. -Female interview respondent, upper wealth stratum

Another wealthy female respondent contrasted her experience during the past two drought-affected years with expectations of what would happen if the rains at the time of the interview continued to be optimal, saying,

> During that time [of drought], what we are just, what we are doing on the small business, that money goes for food. That…keeps our business from growing… I will pray god to bring a good year just like this [current] year every year. If every year is just like this year, my business will grow because I won't give up money for food… the product coming from the land will be enough for my family's food consumption. -Female interview respondent, upper wealth stratum

Adverse impacts on households' livestock holdings, monetary savings, and ability to realize surplus production or profits may have also affected their children's education. While rich and poor households alike felt such impacts, only relatively wealthy households had, in good years, often been able to send their children away from the community for advanced education. Poor households did not have this opportunity to lose. Such training is perhaps the best means of increasing a child's odds of experiencing a major shift in social and economic status (e.g., establishing a non-agricultural career), and as such constitutes a major source of advantage among materially better-off households in Kejima. As one respondent described it,

> Those who are continuing their education, they have a strong and rich father. When they reach to grade seven or eight, their fathers send them to Hawassa and such big towns. Then they will stay there and they don't see anything about marriage or farming because that is the town. People there are not interested in getting married earlier, just to continue their education there… But those fathers who do not have capacity… their children will remain with them. When they reach grade four or five, then the father will say, 'I don't have the capacity to send you to school any more', so they start to get married. -Male respondent, middle wealth stratum.

However, even the wealthiest households in Kejima were still quite asset poor in absolute terms, and thus often remained at the margins of being able to provide such opportunities to their children. In other words, a negative shock could easily undermine their capacity to support their children's advanced education. A respondent from a household that sent its children to Hawassa for education describes what they did, saying,

> Every year we sell our cow and the product which we get from the land, from the farm. We sell for money to send our children to school. Before three or four years, I send three of my children to Hawassa to learn there… Every year we sell cow, production, other production, maize. We sell and we send that money to those boys for house rent, for their food, for their clothes, and everything. -Female interview respondent, upper wealth strata

This response demonstrates that many of the assets that were commonly sold during the crisis were also commonly used for investing in things with long-term implications, such as children's education. During periods of stress, income from these asset sales was likely diverted from education to the household's food. In instances when households' responses to the crisis undermined their ability to send their children for post-primary education, they also diminished those children's odds of major upward social and economic mobility. This is particularly notable since these children represent the only group for whom such escape from Kejima, or places like it, is considered even a remote possibility.

Informal social safety net

The data analyzed in this chapter suggest that initially better-off households tended to endure the period of stress with less negative ramifications than those that were initially asset poor. One female focus group participant's opinion is demonstrative, as she says,

> Those who are better off still now have something to eat, even though it is not as much as before, or containing good vitamins or carbohydrates or something like that. But the poor are just, they are very poor and they don't have something to eat. Even though they have something to eat, it is very, very little… The better off are eating two or three times a day, but the poor—sometimes they do not have a meal even once a day. -Female focus group participant

This is not to say, however, that the better off did not suffer. As another female focus group participant explained,

> Everyone has lost their crop. The better ones have also lost their crops, and even they are in a problem now. The poor are also in a problem. Maybe the degree of the problem is different, but they are all in the problem. -Female focus group participant

The broad impact of the crisis had implications for the informal social safety net in Kejima. These effects are likely to endure well into the future, with potentially significant consequences for resilience to future crises.

The data considered in this analysis demonstrate that transfers and loans often occurred among households. However, the frequency of such assistance decreased over the course of the crisis as better-off households faced increasing constraints themselves. One male respondent explained,

> Those who are better off may help the very poor as much as they can, but when a bad year comes, it makes everybody worse off… It fails for everybody… I don't think that many people are helping the poor, even in the church. -Male interview respondent, middle wealth stratum

A relatively wealthy male respondent explained his own situation by saying,

> I was, myself I was facing a problem, so how can I help others? And the others are also the same. They are in a problem, so how can they help me? Only god and my cows [that I sold] helped me last year. -Male interview respondent, upper wealth stratum

The concerns expressed by this respondent show that inter-household transfers and assistance were contingent upon the welfare of the wealthiest households—those usually in a position of assistance.

The high quality of the rains during the season in which these data were collected contributed to a successful growing season in 2013. Therefore a complete breakdown of the informal social safety net almost certainly did not occur in Kejima. However, the evidence here suggests that such dissolution of the social safety net may occur in more severe or prolonged crises in which even the wealthiest households face existential threats. Given the existence of these inequalities, such a breakdown would undoubtedly compound the plight of poor households that rely upon the redistribution of resources. In contexts of stress and crisis, the fates of households in Kejima are clearly linked.

Perceptions of status

Finally, households' responses to environment stress may have affected others' perceptions of their standing in the community. Respondents from both the upper and lower wealth strata emphasized that independence and benevolence are highly valued traits in Kejima. When asked to characterize an ideal household that was strong or resilient in the face of crisis, one respondent explained,

> The one who is resilient for me is that one who is independent. The independent one. The one who does not need any help from other people, who stands by himself. Who faces a problem by himself. -Female respondent, middle wealth stratum

Such expressions were common in Kejima. Perceptions of a given household's standing certainly declined if it relied upon others, and remained dependent in years after the crisis. Such perceptions may have also declined if a household with the capacity to assist others refused to do so. In contrast, perceptions of the households may have improved if it assisted those in need. Another respondent's description of an ideal typical "resilient" household makes this clear,

> The one who has a bigger land, the one who has a bigger cow, and bigger false banana. And the one who has enough food in his house, and the one who has extra money made by running a business. And the one who helps poor in his area. When the poor come to him, they get some food from him. Those people are considered resilient in our area. - Male interview respondent, middle wealth stratum

Such perceptions are particularly important if the very forms of assistance that are perceived so positively also improve the objective economic standing of the households providing the assistance vis-à-vis those they assist. In such a case, the prevailing ideology through which people perceive these actions would actually legitimize processes that produce or reproduce power and wealth inequalities within the community.

Conclusion

This chapter has identified strategies that households commonly used the cope with rainfall deficits, crop failures, and related resource insecurity during two recent drought-affected years in Kejima. The set and sequence of strategies that households employed varied among wealth strata, as did the motivations for and consequences of these strategies. Importantly, this chapter demonstrated that coping strategies not only have implications for households' relative standing in the community with respect to wealth. These strategies also affect inter-household relationships with complex and sometimes ambiguous implications for households' long-term social and economic status. For example, households in the upper wealth stratum appeared to

gain or reinforce certain advantages throughout the course of the crisis (e.g., command of labor), but may have been adversely affected with respect to forms of advantage they enjoy during years with successful harvests (e.g., children's education). In another example, transfers from relatively rich to ultra-poor households often required sacrifices among the former. However, the future obligations associated with receiving assistance often positioned the better off to improve their economic standing in the aftermath of the crisis. Such obligations may have also contributed to the reproduction of impoverishment and disadvantage among poor recipients of transfers, loans, and wage labor opportunities. Of course, the initial redistribution of resources during the drought proved critical for many of the worst-off households in Kejima, so such costs were likely perceived as unavoidable.

Given these findings, it is difficult to reach an unambiguous conclusion about the implications of coping strategies for households' social and economic mobility, and aggregate community inequality. Nonetheless, this chapter has demonstrated that what may seem to be autonomous household strategies are in fact contingent upon, and have consequences for, the short- and long-term welfare of other households in Kejima and the relative distribution of resources and opportunity.

CHAPTER 5: RAINFALL DEFICITS, HETEROGENEOUS IMPACTS, AND INEQUALITY IN KEJIMA

Introduction

This chapter examines the association between rainfall deficits and changes in asset and livestock inequality within Kejima. It also explores sources of difference in the effect of rainfall deficits on household wealth in Kejima, which are the underlying drivers of changes in asset and livestock inequality. Drawing upon the factors identified by existing research and the reports of residents of Kejima themselves, I analyze the association between hypothesized correlates of vulnerability and the risk of losing (gaining) assets or livestock during a period of rainfall deficit. Together, this set of analyses provides evidence about the relationship between rainfall deficits and inequality, and the underlying differences in household outcomes.

This chapter proceeds as follows. In the first section, I describe recent rainfall patterns in Kejima and outline the assumptions I make to estimate the association between drought, household livestock and asset holdings, and outcomes derived from data on those holdings (e.g., inequality) in Kejima. The subsequent section describes changes in household asset and livestock holdings between 2010 and 2013, including mobility tables and a summary of the changes in mean household assets and livestock holdings attributed to the rainfall deficits. Third, I calculate multiple estimates of between-household asset and livestock inequality in Kejima for all years from 2010 to 2013, and identify rainfall deficit-related changes therein. The chapter's final set of analyses examines the association between drought-related changes in household asset and livestock holdings and a set of characteristics and behaviors expected to contribute to, or reflect household vulnerability to drought. Since heterogeneity in household assets and livestock underlie changes in aggregate between-household inequality, this analysis provides insight into

the micro-level differences that contribute to changes in aggregate community structure. All analyses in this chapter draw upon the household survey data described in Chapter 2 unless otherwise noted.

Rainfall deficits in Kejima

The first step of this analysis was to identify a recent rainfall deficit in Kejima that was significant enough to affect livelihoods in the community. Prior to selecting a research site, key informant interviews with *woreda* and *kebele* officials, CARE staff working in the *woreda*, and farmers all indicated that Kejima had experienced a rainfall deficit—and subsequently diminished crop output—during 2011 and, to a lesser extent 2012. These claims were supported by data collected during qualitative interviews with Kejima residents and estimates of historical rainfall in Kejima produced by NASA'S POWER project.

Among the extensive set of data collected through the POWER project, I draw upon data based upon the Modern-Era Retrospective Analysis for Research and Applications (MERRA) (NASA 2012, Rienecker et al. 2011). Like other re-analyses, MERRA integrates a wide range of previously collected, often spatially- and temporally-irregular data to develop a spatially complete dataset. This particular dataset draws upon a set of surface and satellite data products from the start of the satellite era (1979) to present. Importantly, MERRA was developed with a particular concern for improving upon the hydrologic cycle models used in previous generations of re-analysis, with the objective of developing a product adequate for climate and weather studies (Rienecker et al. 2011: 3625). MERRA data include daily average precipitation estimates from 1984 to the present[42] (with a two-month delay), with global coverage at 0.5° of resolution.

[42] The rainfall data used in this analysis include daily observations from January 1984 through the end of 2011.

As such, these data can be used to identify long-term trends and short-term deviations in precipitation for relatively small geographic areas. Data from the POWER project has been used in previous social science research on the effects of weather shocks (e.g., Gray and Mueller 2012a, Hirvonen, 2014, Mueller 2014).

I use these data to consider recent rainfalls in Kejima compared to historical trends. Table 5.1 shows (a) estimated monthly rainfall in Kejima (2010-2012), (b) 20-year means for monthly rainfall, and (c) observed monthly rainfall deficits (or surpluses) relative to the 20-year mean, expressed in terms of millimeters (mm). Slight deficits were observed in the first three months of 2011,[43] as well as December 2011 and the first two months of 2012. Rainfall deficits during these periods—particularly during February and March—have implications for *Belg* and long-cycle (*Belg and Kiremt*) crops. A false start to the *belg* rains may lead to a failure of first-season crops among early planters, or delayed planting—and thus diminished output—among those who delayed planting their crops.

To put these monthly rainfall deficits in context, I considered how each monthly deficit observed in 2011 and 2012 compared to all observed monthly deficits (1981-2013) for those same months (results not shown). For instance, in years with below normal rainfall in February (1981-2013), the average deficit was approximately -32mm. According to these records, the monthly rainfall deficit observed in January 2011 (-16.5mm) was only half the severity of average deficits (1981-2013); the same holds true for the monthly deficits seen in February and March of that year. The three months of rainfall deficits prior to the 2012 growing season were near or slightly below average severity. The deficit in December 2011 was slightly more than

[43] Here, it is important to note that long-term trends in monthly (or other period) precipitation are typically not normally distributed, so means and z-scores must be interpreted with caution (Viste et al. 2013). One alternative approach—estimating probabilities using a gamma distribution—yielded similar results, and the other data discussed in this chapter support the conclusion that rains in 2011 and 2012 were poor enough to adversely affect crop production.

half as severe as the average deficit in that month; and the deficits in January and February 2012 were approximately average in severity. These data suggest that rainfall prior to the 2011 and 2012 growing seasons were not ideal, but were not exceptionally poor by historical standards.

Table 5.1 *Summary of rainfall in Kejima, by year*

Year	Month	Rainfall (mm)	Mean (mm) (1981-2012)	Deviation from mean (mm)
2010	Jan	53.2	50.6	2.6
	Feb	180.7	44.9	135.7
	Mar	261.9	110.3	151.6
	Apr	298.6	201.9	96.7
	May	486.5	254.4	232.1
	Jun	349.2	311.1	38.1
	Jul	460.7	370.8	89.9
	Aug	432.1	356.5	75.6
	Sep	357.7	318.1	39.7
	Oct	207.2	213.1	-5.9
	Nov	122.6	85.7	36.9
	Dec	93.0	47.4	45.6
2011	Jan	34.1	50.6	-16.5
	Feb	36.5	44.9	-8.5
	Mar	86.1	110.3	-24.2
	Apr	208.3	201.9	6.4
	May	448.0	254.4	193.6
	Jun	399.3	311.1	88.2
	Jul	405.3	370.8	34.5
	Aug	416.5	356.5	60.0
	Sep	437.6	318.1	119.5
	Oct	302.3	213.1	89.2
	Nov	227.9	85.7	142.1
	Dec	29.7	47.4	-17.7
2012	Jan	15.5	50.6	-35.1
	Feb	26.8	44.9	-18.1
	Mar	142.0	110.3	31.7
	Apr	295.6	201.9	93.7
	May	323.1	254.4	68.7
	Jun	332.7	311.1	21.6
	Jul	442.0	370.8	71.2
	Aug	406.3	356.5	49.8
	Sep	400.5	318.1	82.4
	Oct	217.5	213.1	4.3
	Nov	227.2	85.7	141.5
	Dec	54.5	47.4	7.1
2013	Jan		N/A	
	Feb		N/A	
	Mar		N/A	
	Apr		N/A	
	May		N/A	

Source: NASA-POWER

Of course, these analyses utilize a fairly short time series of data, and do not identify consequential intra-month rainfall variation. Given these limitations, I also examined archival data from the Famine Early Warning System Network (FEWSNET), which tracks a large set of agro-climatic and livelihood data across the developing world to provide cross-sectional assessments of agro-ecological conditions and food security across the developing world (see http://www.fews.net). As such, FEWSNET analyses almost certainly provide a better assessment of food security than could be derived from rainfall data alone.

FEWSNET reports suggest that residents of Kejima and surrounding areas faced a much more difficult situation than the rainfall data above suggested. For instance, the Food Security Outlook/Update for May/June 2011 placed Kejima in an area estimated to be facing "crisis" or "emergency" food insecurity in June 2011; this same report predicted such conditions to continue through September of that year (FEWSNET 2011). Specifically, the report stated,

> [SNNPR] has also been significantly affected by poor rainfall over the past four months. Despite some rains since April, shortages of water and pasture remain serious in some lowland areas… Information from ongoing monitoring and recent rapid assessments indicate widespread increasing trends in the prevalence of acute malnutrition…Staple food prices, particularly maize; have been displaying abnormal rising trends in the last few months. In Wolayita, maize prices jumped from 3.71 Birr/kg in February to 5.5 Birr/kg in May, an increase of 56%. Deteriorations in food security, due to failure of sweet potato and other gap filling crops (cabbages and haricot beans), delays in green harvest of maize and Irish potato, poor prospects for the *Belg* harvest as well as unusual rises in food prices, is expected to keep thousands of poor households in the most affected zones of the region in Crisis (IPC Phase 3) until the next *Meher* harvest begins in October (FEWSNET 2011).

Reports from 2012 also paint a bleak picture. For example, the Food Security Outlook from May 2012 described the region in which Kejima is located, saying,

> The late onset of the Belg rains in the current season has delayed the planting of Belg crops that normally takes place in February and March. Farmers in the root crop areas started planting in April, and the planted area is below normal. Harvesting of haricot beans and Irish potatoes is expected to start around the middle of July. The availability of green maize for consumption will not be available until the end of August or early

> September. The harvests are also likely to be below normal due to the late planting, low planted area, and the potential damages by the heavy rains during the June to September Kiremt rains (FEWSNET 2012).

Both reports suggest that the rainfall deficits observed in the months prior to the 2011 and 2012 growing seasons did have significant implications for the timing of planting and quality of crops. Moreover, these reports capture other institutional factors (e.g., high food prices) that also had negative effects on food security in the area at that time.

As a final piece of evidence—after key informant interviews and analysis of the MERRA data—I consider interviews with Kejima residents, who also suggested that the 2011 and 2012 rains were poor in terms of both quantity and timing. As one respondent put it, somewhat hyperbolically, "Last year there was no rain, and then there was no crop." Importantly, others emphasize the timing of the rainfall. One farmer said, "Before last year [meaning 2011], the rain stopped when we sowed the crop, the rain stopped and the crop dried out." Another agreed, saying, "The year before last the rain stopped in the middle and the crops were dried out. By that we lost every crop and we faced a shortage…that [year]." These responses are consistent with the rainfall estimates from NASA, which show that rainfall was slightly below average during the usual planting period. The above responses also indicate that within-month rainfall variation—something not captured by the analysis of NASA data—may also be important.

Although the rainfall data suggest that the start of the *Belg* rains was less delayed in 2012 than 2011, a number of farmers also noted that the distribution of rainfall within particular months of 2012 adversely affected crop output. For example, one farmer said,

> Last year [2012] was a bad year because the rain started in late April and the beginning of May and it stopped in the middle of May also, in the middle of May when the [maize] crops are flowering. Then everything has dried; this area is an arid area. If the rain stops four five six seven days, it dries. Everything will be dry. So last year was bad year.

With few exceptions, interview respondents identified 2011 and 2012 as years of poor rain and crop output relative to both 2010 and the unfolding rainy season during the months (May and July) in which most of the qualitative interviews were conducted. Together, these sources of data provide evidence that crop production in 2011 and 2012 was indeed adversely affected by rainfall deficits and related food insecurity.

Estimating drought-related changes in social outcomes

I use a very basic interrupted time-series approach to estimate the association between drought and changes in household wealth and within-community inequality. This approach compares pre-rainfall deficit trends in inequality (community level) and asset and livestock holdings (household level) with the changes in those outcomes during the drought. The results therefore show whether the period of drought marked a continuation or discontinuation in pre-drought patterns. Of course, the objectives of this analysis are descriptive. Establishing causality at the micro-level in a single-village case study is a dubious enterprise because such studies lack both cases from comparable drought-affected communities and a comparison, or control group of non-affected cases. Likewise, it is not possible to account for many potentially confounding community-level processes in such cases.

I estimate drought-related changes in assets and livestock as follows: I start by calculating the change in a given outcome (Y) of interest between the start of 2010 and the start of 2011, which I signify as Δ_1. In this study, outcomes include indicators of within-community inequality and household wealth. Δ_1 represents the trajectory of any given Y during the normal

growing season in Kejima prior to the deficit-affected years.[44] I assume that this trend would have continued through 2013 in the absence of rainfall deficits. I then calculate changes in Y between the start of 2011 and the time of the survey (May 2013), or Δ_2. This captures changes in Y between the end of a year with relatively normal rainfall (measured in January 2011) and the conclusion of the second "hungry season" in the two drought-affected years (measured in May 2013), when deprivation was likely at among the most severe levels.[45] In other words, it captures change between a likely peak and trough in food security in the community.

Assuming an absence of confounding changes between 2011 and May 2013, the association between rainfall deficits and Y, which I signify as R, can be calculated by comparing the slopes of Δ_1 and Δ_2, or:

$$R = \frac{\Delta_2}{n_2} - \frac{\Delta_1}{n_1}$$

where $n_1$and n_2 are the number of years (or other temporal units) between times t_1 and t_2 for Δ_1 and Δ_2, respectively. I modify this approach to present the results in a more intuitive manner—and one that does not suggest that the effect of drought is linear over the 2011-May 2013 period. Specifically, I compare the observed value of any given Y in May 2013 with the value of Y expected if trend Δ_1 would have continued to May 2013, or:

$$R = Y_{2013} - (Y_{2011} + [\Delta_1 * \frac{n_2}{n_1}])$$

Presuming the absence of confounding changes—or systematic and unobserved recall bias—over this time period is a strong assumption. For example, numerous unobserved, idiosyncratic changes at the household level may have occurred (e.g., changes in family

[44] It is important to emphasize that Kejima has been affected by rainfall shocks in the past. As other parts of this dissertation have discussed, such shocks often have enduring effects. Thus Δ_1 may be influenced by past events. This again highlights the challenges of making claims about causality in chronically shock-affected environments.
[45] During years with normal rainfall, May usually falls within the worse of the so-called hungry period. This is compounded when crop output is below normal during a previous year(s).

composition, income-generating opportunities). Moreover, food, livestock, and agricultural input markets may change rapidly over even short periods of time, with clear implications for households' economic status and, given heterogeneous effects of such changes, inequality within the community. Such assumptions are necessary for a case study of this nature, and the results should be interpreted with this in mind.

Wealth dynamics in Kejima, 2010-2013

To begin, I summarize household livestock (Table 5.2) and asset (Table 5.3) holdings at the start of each year from 2010 to 2013 and at the time of the survey (May 2013). Here, I report livestock in terms of Tropical Livestock Units (TLU). TLUs are a commonly used means of quantifying herds of livestock into a single metric that can be compared across herds with different compositions and from different regions across the world. Using weights for Northern Africa cited in Chilonda and Otte (2006) and Tilahun and Schmidt (2012), I weight both cattle and oxen as 0.7 TLU, donkeys as 0.6 TLU, horses as 0.4 TLU, goats and sheep as 0.1 TLU, and chickens as 0.01 TLU.

Results show that mean total household livestock holdings decreased between 2010 and the time of the survey. In 2010, the average household held 2.71 TLUs of livestock, but only 1.97 TLUs in May 2013. The standard deviation of household livestock (TLU) also decreased over this period, showing that dispersion of household holdings about the mean declined. Similar declines were observed with respect to holdings of particular types of livestock, with the exception of horses and chickens. Horses were extremely rare in both 2010 and 2013, but the increase in proportion of chicken holdings was substantial. In 2010, the average household owned almost two-thirds more cattle than chickens, but by May 2013 chickens were the most

common animal among the average household's holdings. At the time of the survey, the average household had more than two chickens for every cow they owned. These changes mark a more general decrease in the size and economic and nutritional value of the average household's livestock composition from before to after the failed rains. Assuming that the changes observed between the start of 2010 and 2011 would have continued in the absence of these rainfall deficits, these shocks were associated with a 0.615 TLU decrease in mean household livestock holdings, and a shift from large, high-value livestock to small low-value chickens. This finding is consistent with expectations that livestock sales play an important role in household coping strategies.

Table 5.2 *Summary of household livestock holdings, by year*

Variable	2010		2011		2012		2013		2013 (May)		Obsv. - expect. 2013 (May)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Cattle	2.60	2.08	2.52	2.04	2.25	1.76	1.60	1.18	1.65	1.16	-0.67	1.84
Ox	0.68	1.03	0.69	1.03	0.61	0.90	0.58	0.78	0.62	0.77	-0.10	0.92
Goat	0.80	1.97	0.80	1.96	0.82	2.44	0.71	2.28	0.75	2.28	-0.05	1.76
Sheep	0.72	1.77	0.71	1.76	0.63	1.70	0.37	0.85	0.47	1.12	-0.21	1.86
Donkey	0.40	0.90	0.40	0.89	0.38	0.81	0.33	0.55	0.38	0.62	-0.02	0.75
Horse	0.01	0.10	0.01	0.10	0.02	0.14	0.02	0.14	0.03	0.23	0.02	0.14
Chicken	1.68	3.29	1.68	3.29	1.66	3.22	1.81	2.24	2.11	2.66	0.42	3.35
Total TLUs	2.71	2.20	2.66	2.17	2.40	1.93	1.85	1.48	1.97	1.54	-0.62	1.41

Source: Kejima Household Survey

In contrast to trends in livestock holdings, households tended to accumulate other (non-livestock) assets between 2010 and 2013 (Table 5.3). Expressed in terms of the average market prices reported by respondents in May 2013[46], households accumulated nearly 700 ETB worth of assets during this period, excluding the influential effect of a single motorcycle purchase on the

[46] According to these calculation, I value assets as follows: beehive (250 ETB), axe (49.4 ETB), machete (51.4 ETB), sickle (64.9 ETB), spade (67.6 ETB), grain mill (25 ETB), hoe (29.2 ETB), bucket (42.1 ETB), plow yoke (65.2 ETB), plow beam (80.0 ETB), blanket (283.5 ETB), chair (65.3 ETB), table (100.5 ETB), cupboard (800.0 ETB), mat (205.9 ETB), lantern or torch (243.7 ETB), watch or clock (48.3 ETB), radio or cassette player (254.0 ETB), mobile phone (515.8 ETB), bicycle (4,000.0 ETB), motorbike (27,500.0 ETB).

mean. Much of this increase occurred during years with rainfall deficits. Household assets were nearly 600 ETB higher in May 2013 than would have been expected if the 2010-2011 trend had continued. Of course, it is worth emphasizing that these changes were incremental: 600 ETB is the approximate value of a mobile phone and chair, according to reported prices. With the exception of beehives (non-durable) and bicycles (rarely held), the average household accumulated each particular type of asset at a higher—but nonetheless minimal—rate during years affected by rainfall deficits than the 2010-2011 period. Although the slight uptick in household assets was not expected, it is consistent with expectations that the assets considered in this indicator were not often sold as a part of households' coping strategies.

Table 5.3 *Summary of household assets, by year*

Variable	2010		2011		2012		2013		2013 (May)		Obsv. - expect. 2013 (May)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Beehive	0.15	1.25	0.15	1.25	0.15	1.25	0.15	1.25	0.14	1.14	-0.01	0.10
Axe	0.61	0.61	0.63	0.62	0.66	0.63	0.79	0.76	0.80	0.75	0.12	0.68
Machete	0.27	0.53	0.29	0.56	0.31	0.58	0.39	0.64	0.40	0.64	0.06	0.59
Sickle	0.37	0.53	0.38	0.53	0.47	0.54	0.64	0.56	0.72	0.54	0.31	0.60
Spade	0.41	0.69	0.45	0.70	0.51	0.71	0.59	0.72	0.63	0.72	0.08	0.65
Hoe	0.64	0.77	0.66	0.78	0.68	0.82	0.79	0.87	0.84	0.87	0.13	0.69
Bucket	0.29	0.81	0.29	0.81	0.29	0.81	0.31	0.85	0.33	0.87	0.03	0.23
Plow yoke	0.32	0.47	0.32	0.47	0.32	0.47	0.35	0.48	0.38	0.49	0.06	0.24
Plow beam	0.29	0.46	0.29	0.46	0.29	0.46	0.33	0.47	0.34	0.48	0.04	0.20
Grain mill	0.01	0.10	0.01	0.10	0.01	0.10	0.01	0.10	0.01	0.10	0.00	0.00
Blanket	0.93	0.78	0.96	0.77	1.06	0.78	1.27	0.75	1.32	0.70	0.29	0.78
Chair	0.86	1.20	0.86	1.20	0.93	1.21	0.99	1.22	1.13	1.36	0.26	0.90
Table	0.29	0.56	0.32	0.62	0.41	0.68	0.49	0.68	0.53	0.68	0.16	0.67
Cupboard	0.24	0.80	0.24	0.80	0.24	0.80	0.24	0.80	0.57	1.18	0.33	0.96
Mat	0.17	0.40	0.17	0.40	0.20	0.47	0.21	0.48	0.21	0.48	0.04	0.20
Lantern	0.11	0.31	0.11	0.31	0.12	0.32	0.24	0.43	0.24	0.43	0.14	0.35
Watch/clock	0.04	0.25	0.04	0.25	0.04	0.25	0.06	0.28	0.09	0.36	0.05	0.30
Radio	0.07	0.26	0.07	0.26	0.07	0.26	0.08	0.31	0.07	0.30	0.00	0.15
Mobile	0.07	0.26	0.08	0.28	0.17	0.38	0.32	0.59	0.44	0.68	0.33	0.69
Bicycle	0.02	0.14	0.02	0.14	0.02	0.14	0.02	0.14	0.01	0.10	-0.01	0.10
Motorbike	0.00	0.00	0.00	0.00	0.01	0.10	0.02	0.14	0.02	0.14	0.02	0.14
Total asset value (2013 prices)	953.88	1211.13	976.64	1211.94	1374.53	.3276.725	1884.21	4488.74	2202.59	4495.05	1173.59	4243.64
Total asset value (2013 prices, exl. motorbike)	953.88	1211.13	976.64	1211.94	1085.05	1201.57	1305.27	1222.97	1623.64	1387.41	594.64	831.98

Source: Kejima Household Survey

To illustrate how livestock and asset dynamics during the drought period differed across wealth strata, Tables 5.4-5.7 show the percentage of households making transitions between—or remaining in—variously-defined wealth quartiles over the course of the rainfall deficit-affected years (2011-2013). When interpreting these results, recall again that one head of cattle or oxen is weighted as 0.7 TLU, a donkey as 0.6 TLU, a horse as 0.4 TLU, a goat or sheep as 0.1 TLU, and a chicken as 0.01 TLU. With respect to asset values, 260 ETB—nearly the range of the lowest quartile in 2011—represents the approximate combined value of an axe (49 ETB) machete (51 ETB), sickle (64 ETB), spade (68 ETB), and hoe (29 ETB) (see footnote #47 for all mean asset values).

Table 5.4 *Household mobility, livestock ownership quartiles (constant 2011 cutoff)*

		2013 (May)				
	TLU	0-0.9	0.9-2.2	2.2-4.1	4.1+	N
2011	0-0.9	79.2%	20.8%	0.0%	0.0%	24
	0.9-2.2	34.8%	47.8%	13.0%	4.3%	23
	2.2-4.1	4.2%	66.7%	29.2%	0.0%	24
	4.1+	0.0%	16.7%	41.7%	41.7%	24
	N	28	36	20	11	

Source: Kejima Household Survey

The data in Table 5.4 show the proportion of households in a given livestock quartile in 2011 (vertical axis) that transitioned into a new wealth quartile by 2013 (horizontal axis), using the inter-quartile ranges (IQR) defined in 2011. This table summarizes absolute mobility with respect to livestock ownership during years with rainfall deficits. Households in the poorest quartile were least likely to make a transition, which in part reflects the floor or limit on downward mobility for this group. However, the poorest were slightly more likely to make an upward transition (20.8%) between 2011 and 2013 than households that were in the second quartile in 2011 (17.4%). Rates of absolute downward mobility were highest among those in the

third (70.9%) and fourth (58.3%) wealthiest quartiles in 2011. This suggests that the distribution of household livestock holdings within Kejima likely compressed between 2011 and 2013, and was driven largely by declines in livestock holdings among the most livestock-rich households in 2011.

Table 5.5 *Household mobility, livestock ownership quartiles*

		2013 (May)				
	TLU	0-0.74	0.7-1.4	1.4-2.6	2.6+	N
2011	0-0.9	70.8%	16.7%	12.5%	0.0%	24
	0.9-2.2	13.0%	60.9%	21.7%	4.3%	23
	2.2-4.1	0.0%	25.0%	54.2%	20.8%	24
	4.1+	0.0%	4.2%	25.0%	70.8%	24
	N	20	25	27	23	

Source: Kejima Household Survey

The data in Table 5.5 also summarize households' transitions with respect to livestock holdings between 2011 and 2013, but considers IQRs calculated in both 2011 and 2013. That is, this analysis accounts for changes in the relative rank of households' livestock holdings. Importantly, many of the better-off households that experienced absolute downward mobility (Table 5.4) may not have experienced drastic reductions in their relative position within the community. For example, only 41.7% of the households in the upper wealth quartile in 2011 remained there in 2013 when using 2011 IQRs; but 70.8% remained in the upper wealth quartile when considering 2013 IQRs (i.e., the measure of relative mobility). Moreover, a substantial proportion of households that did not experience major absolute gains (e.g., upward mobility in Table 5.4) nonetheless increased their relative rank between 2011 and 2013. For example, no households in ranked in the third quartile in 2011 made the transition above 4.1 TLU of livestock in 2013 (Table 5.4), but 20.8% moved from the third to fourth quartile between 2011 and 2013 using year-specific ICRs (Table 5.5). These households apparently experienced upward relative

mobility by simply maintaining their livestock holdings, or losing less than other households that were ranked above them in 2011.

Table 5.6 *Household mobility, asset (price) ownership quartiles (constant 2011 cutoff)*

		2013 (May)				
	Assets (price)	0-276	276-645	645-1244	1244+	N
2011	0-276	8.7%	39.1%	34.8%	17.4%	23
	276-645	0.0%	37.5%	29.2%	33.3%	24
	645-1244	0.0%	0.0%	50.0%	50.0%	24
	1244+	0.0%	0.0%	0.0%	100.0%	24
	N	2	18	27	48	

Source: Kejima Household Survey

Tables 5.6 and 5.7 provide similar summaries of household transitions with respect to total asset holdings, weighted by the mean market price reported by survey respondents in May 2013. Here, the striking feature is the lack of absolute downward mobility, and the high rates of absolute upward mobility among households that were most asset-poor in 2011. This suggests that potential compression of the household asset distribution within Kejima between 2011 and 2013 may be driven largely by gains among the households in the lower half of the 2011 asset distribution. In many cases, differences in absolute gains in assets between 2011 and 2013 were enough to affect households' relative ranks (Table 5.7). This finding may reflect at least three, inter-related factors: (1) a disconnect between rainfall, reduced crop production, and the assets considered in this measure; (2) minimal changes in household assets (i.e., low rates of exchange); and (3) limited imperative to accumulate large numbers of the assets considered in the measure (i.e., an effective ceiling on asset ownership).[47]

[47] The asset rich may hit a "ceiling" of the assets used in this measure, since accumulating more household implements would provide little use value. As a result, changes in assets were more likely to occur among the asset poor.

Table 5.7 *Household mobility, asset (price) ownership quartiles*

		2013 (May)				
	Assets (price)	0-713	713-1258	1258-2081	2081+	N
2011	0-276	47.8%	34.8%	17.4%	0.0%	23
	276-645	54.2%	12.5%	12.5%	20.8%	24
	645-1244	0.0%	50.0%	33.3%	16.7%	24
	1244+	0.0%	0.0%	41.7%	58.3%	24
	N	24	23	25	23	

Source: Kejima Household Survey

Inequality dynamics, 2010-13

The simple mobility tables above provide insight into how absolute and relative changes in livestock and asset holdings during years affected by rainfall deficits (2011-13) varied according to households' pre-deficit (2011) wealth status. This section builds upon those results by quantifying between-household asset and wealth inequality in Kejima, and estimating the association between rainfall deficits—and unobserved household responses to related food insecurity—and changes in inequality between 2011 and 2013.

While calculating inequality indices is a straightforward exercise, household assets and livestock must be accurately defined and weighted (i.e., valued) to produce meaningful estimates of inequality (see Michelson et al. 2013 for discussion and analysis of asset weighting choices). With respect to defining assets and livestock, I consider all of those listed in each category above (Tables 5.2 and 5.3). With respect to the weighting problem, I use TLUS to weight livestock (described above). No such weights exist for household assets (McKenzie 2010, Montgomery et al. 2000). Rather than using a simple count or applying arbitrary weights, I follow Sahn and Stifel's (2000) approach and use factor analysis to estimate the association between a given observed household asset and some unobserved level of wealth, which I assume takes the form

of a linear relationship.[48] Using the scores from the first factor loading, I construct a wealth index for which each household's score is a weighted sum of their assets, re-centered by +1.1 to facilitate inequality measures.[49]

I also construct livestock and asset inequality indices using weights defined by the mean local market price (reported in May 2013) of each livestock and asset, as reported by survey respondents. Specifically, I use the mean price reported by respondents for each asset and livestock type. Compared to geographically broad analyses, the market prices that households may receive for their livestock and assets may vary substantially less across Kejima, diminishing one of the major drawbacks to using price-weighted measures in large-n studies of this topic. As such, the estimates using price-based weights may provide a useful robustness check on the TLU and index-weighted measures. However, considerable heterogeneity in prices—both across time and according to asset quality—likely exists (Barrett et al. 2003). The price-based weights—and indeed all of the weights used in this analysis—assume assets are homogenous entities. A violation of this assumption could have significant implications for the estimates produced in this analysis. For example, if asset quality is positively associated with wealth (e.g., the wealthy possess higher-quality livestock), use of mean asset prices will lead to systematic undervaluation of wealthy households' assets and overvaluation of poor households' assets—thus underestimating levels of inequality. Of course, the opposite could also hold true, perhaps due to the low levels of attention and care afforded to each head of livestock in large herds. While necessarily, this assumption should be kept in mind when interpreting the results below.

[48] I use the pooled (2005 and 2011) data when constructing the wealth index in order to make accurate comparisons between observations at different time periods.

[49] Nearly all standard inequality measures cannot be calculated using observations ≤0. I address this problem by re-centering index scores by +1 in the final analysis. Since this is an arbitrary choice, I use a number of other values in robustness checks.

Using the resulting weighted household asset and livestock counts, I calculate within-community (between-household) asset and livestock inequality using the Theil index. In this study, these indices capture inequality between households in Kejima, since asset and livestock ownership is measured at the household level. Relative to other measures of inequality (e.g., Gini coefficient), the Theil index has the advantageous characteristic of additive decomposability. This will facilitate comparable estimates in future research on the impact of environmental shocks on inequality within and between other social and spatial units (e.g., between-group, between-community). The formula for the Theil index is expressed as

$$H = \frac{1}{n}\sum_{i=1}^{n}\left(\frac{x_i}{\mu}\right)\log\left(\frac{x_i}{\mu}\right)$$

where, in this case, n is the number of households in Kejima, x_i is the value of a given household's (i) weighted assets or livestock, and μ is the mean household asset or livestock value in Kejima. Like all other General Entropy class measures, the Theil index measures the distance of a given population from a state of maximum entropy (i.e., equality or disorder). As such, a Theil index value of 0 indicates perfect equality, with inequality increasing as values approach 1.

Livestock and asset inequality was moderate—near the middle of *H's* theoretical range [0,1]—within Kejima at baseline (2010) according to all indices (Table 5.8). Asset inequality (*H* = 0.4816 [index], 0.6009 [price]) was markedly higher than livestock inequality (*H*=0.3335 [TLU], 0.314 [price]). Among asset inequality indices, the price-weighted Theil index (*H*=0.6009) was higher than the index-weighted index (*T*=0.4816). This reflects the mathematical constraints on variance imposed when constructing the index (Sahn and Stifel 2000). According to all indices, livestock and asset inequality decreased over the 2010-2013 period. Using the simple interrupted time-series approach described above, the results indicate

that levels of both livestock and asset inequality observed in May 2013 were substantially lower than was expected if 2010-2011 inequality trends had continued to 2013. Assuming the absence of other confounding factors, these results suggest that exposure to rainfall deficits was associated with equalization of livestock and asset holdings in Kejima. I consider the generalizability of this finding in the next chapter (Chapter 6).

Table 5.8 *Between-household asset and livestock inequality (H) in Kejima, by year*

	2010	2011	2012	2013	2013 (May)	Obsv. - expect. 2013 (May)
Livestock (TLU)	0.3335	0.3362	0.3192	0.3023	0.2834	-0.0589
Livestock (prices)	0.3145	0.3168	0.3178	0.3258	0.3071	-0.0148
Assets (index*)	0.4816	0.4530	0.3789	0.2576	0.2258	-0.1613
Assets (prices**)	0.6009	0.5642	0.4479	0.3168	0.2896	-0.1903

**Index excludes motorbike and grainmill due to low variance; **Price-weighted index excludes motorbike due to influential observation*

Source: Kejima Household Survey

Heterogeneous effects among households

By definition, changes in scale-invariant indices of between-household asset and livestock inequality are driven by heterogeneous changes in household asset and livestock holdings, respectively (Allison 1978). I begin to investigate the factors that explain differences in the association between rainfall deficits and changes in household asset and livestock holdings. By identifying the factors associated with particularly large losses (or gains) in wealth during recent rain deficits in Kejima, this analysis provides evidence about the heterogeneous effects among households that contributed to changes in inequality in Kejima.

This part of the analysis centers on four linear regression models, which I estimate using Ordinary Least Squares (OLS). The first two sets of models predict deficit-related changes in total household livestock holdings. The first of these considers livestock weighted using TLUs; and the second weights livestock using respondent-reported market prices. The second two sets

of models predict deficit-related changes in total household asset holdings. One uses respondent-reported market prices; and the second series uses the factor analysis-derived weights described above. I follow an identical model-building strategy for all four sets of models. I describe this strategy below, and include descriptive statistics for each of the variables included in these models in Table 5.9

Table 5.9 *Summary of outcome and explanatory variables*

Variable		Mean	SD	%
Livestock change (TLU)		-0.615	1.412	
Livestock change (price)		-2901.604	8268.229	
Assets change (price)		1173.590	4243.636	
Assets change (index)		0.310	0.439	
Household size		6.578	1.403	
Housholder=female				9.5
Dependency ratio		1.200	0.488	
Land (start 2011, ha)		0.494	0.320	
Cmty lship 2010 =yes				28.4
Other shocks 2010=yes				24.2
Births 2010=yes				16.8
PSNP 2010|2011= yes				41.1
Meal freq*size 2010 (TLU)		14.839	5.630	
Livestock (start 2011, TLU)		2.658	2.172	
Livestock (start 2011, price)		14063.860	11168.230	
Assets (start 2011, price)		976.642	1211.943	
Assets (start 2011, index)		0.960	0.930	
Births 2011-13=yes				76.8
Other shocks 2011-13	=1			31.6
	=2			22.1
	=3			25.3
PSNP 2012|2013=yes				35.8
Off-farm labor 2011-13=yes				49.5
Borrowed/received money 2011-13=yes				59.0
Food transfer in 2011-13=yes				69.5
Meal freq*size 2011-13 (mean)		14.256	4.764	

Source: Kejima Household Survey

In each series of models, the first two predict the impact of rainfall deficits using only exogenous variables. That is, variables that could not have been affected by the rainfall deficits of 2011 and 2013, or households' responses to those deficits. The first model includes (1) household size (start of 2011); (2) householder sex; (3) household dependency ratio (start 2011)[50]; land holdings (start of 2011); community leadership during 2010[51]; participation in PSNP during 2010 and/or 2011[52]; and food security in 2010[53]. As I have defined it, the estimated effect of rainfall deficits is, in part, a function of changes in household asset and livestock holdings between 2010 and 2011 (Δ_1). To ensure that Δ_1 reflects household trends in a normal year, these initial models also control for births and other shocks that occurred during 2010 and therefore likely affected Δ_1.[54] Finally, I control for household livestock and asset holdings at the start of 2011. This is important because the estimated impact of rainfall deficits on household wealth (2011-2013) is theoretically constrained by the amount of livestock and assets held at 2013 (i.e., $\Delta_2 \leq Y_{2011}$), and may very according to baseline wealth. In all four series of models, I introduce 2011 livestock or asset holdings in the second model to capture potential changes the other model coefficient estimates that may reflect mediating relationships or collinearity with other factors associated with baseline wealth.

The third model in each series introduces controls for births and other shocks experienced by households during the 2011-2013 period, which may have confounded initial estimates of rainfall deficit impacts. The set of covariates introduced into the final model includes indicators

[50] Dependency ratio = (persons age <15 + persons age 60+) : (persons age 15-59).
[51] This binary variable is coded 1 if any household member reported serving in a leadership role of any community organization or local government body. Examples include: government official, church leader, savings group secretary, or development group organizer.
[52] PSNP participation in 2011 was ostensibly determined in 2010 or early in 2011, likely before the effects of rainfall defects were apparent.
[53] This is measured by calculating the average product of (a) meal size and (b) meal frequency reported for each month by respondents. In this instance, the variable is the average product for all months in 2010. This indicator was constructed using the average size and frequency of meals reported by respondents for all months 2010-2013.
[54] Other shocks include: livestock disease, drop disease, household illness or death, and theft or loss of assets.

of household behaviors observed between 2011 and 2013 that were likely responses to the shock and its effects. These include participation in wage or in-kind labor markets; borrowing money or receiving monetary transfers; receiving food transfers; and mean food security (2011-2013). Given that responses are both a function of strategic behavior and household capacity (constraints), many of these covariates may also reflect vulnerability, or lack thereof, to the shock. As such, however, these variables are likely to be endogenous to the estimated deficit-related changes in asset and livestock holdings. These estimates should therefore be interpreted with caution. These models also include controls for PSNP participation during 2012-2013. Although PSNP support is ostensibly targeted on variables included in this model—mainly asset poverty and food insecurity—potential PSNP effects may reflect unobserved vulnerability or targeting.

The first three sets of models include a fifth specification, which is identical to the fourth but excludes observations without livestock (Tables 5.10 and 5.11) or assets (Tables 5.12) at the start of 2010 and 2011. Since the estimated wealth index does not identify households with zero wealth per se, the final series of models (Table 5.13) does not include a fifth model. In all four sets of models, the fourth and fifth specifications exclude indicators of pre-shock PSNP participation and food security because of multi-collinearity.

Livestock

The first set of models (Table 5.10) predicts the effect of rainfall deficits on household livestock holdings, measured using TLUs. Here, it is important to recall that the outcome variable represents the change in household livestock associated with the rainfall deficits, not the absolute level of change between 2011 and 2013. The first two models indicate that households

that were wealthy and food secure prior to the rainfall deficits (2010) experienced the largest deficit-related declines in livestock. The observed land ownership effect in Model 1 becomes non-significant after introducing pre-drought livestock holdings in Model 2, reflecting the high correlation between land and livestock holdings.[55] These wealth effects should not be interpreted as an indication that the wealthy were more vulnerable to shocks than the poor: households that were wealthier at baseline simply have more livestock to sell off than the poor. These households may also have been more likely to perceive that they could sacrifice livestock for food or other necessities during periods of stress without seriously jeopardizing their long-term social and economic status. Finally, households with large herds may have experienced higher absolute levels of livestock mortality.

The estimates of Model 2 also suggest that households receiving PSNP benefits prior to years with rainfall deficits experienced greater losses than non-beneficiaries, net of wealth and other factors. Disproportionate losses among PSNP beneficiaries could be a function of the labor requirements associated with PSNP participation. Time spent away providing labor for public works projects could come at the expense of time allocated to animal husbandry. Alternatively, PSNP beneficiary households may have been more like to sell their livestock to fill short-term consumption gaps knowing that they could use future guaranteed monetary transfers to replenish their savings (e.g., for the next year's agricultural inputs). Finally, this result could also reflect a non-random problem in the targeting of PSNP aid (i.e., selection of participants).

Model 3 introduces controls for exposure to other potentially confounding shocks between 2011 and May 2013. Household births did not have a significant association with changes in assets, but exposure to other shocks was associated with increases livestock losses.

[55] Despite the correlation between livestock wealth and land ownership, tests for multi-collinearity are negative in Model 2.

Together, these controls diminish the magnitude (and statistical significance) of the pre-shock PSNP indicator, which is consistent with the interpretation that PSNP households are more vulnerable and shock-prone than others.

Model 4 introduces a number of variables indicating household responses and resource access during rainfall deficit years. These models exclude measures of pre-shock PSNP participation and food security because of collinearity with indicators of PSNP participation and food security during 2012-2013. As previously mentioned, these results may be biased by endogeneity problems. Introducing household response and resource access variables has little impact on estimates of previous models: pre-shock livestock holdings and exposure to other random shocks between 2011 and 2013 are associated with high (negative) impacts, and in these models (4 and 5), births are associated with low (positive) impacts but only at marginal levels of significance.[56]

The indicator of PSNP participation during rainfall deficit years has a similar effect as the indicator of pre-drought participation in Model 3, reflecting the considerable overlap between beneficiary populations over these two sets of years. However, the indicator of reported food security during deficit years was non-significant (Models 4 and 5). This may reflect the relatively low variation in reported food security and/or the likely association between reported food security and the controls for household wealth included in the model.

Estimates from Model 4 also suggest that households who received food transfers during the drought were less likely to lose livestock, as indicated by the positive coefficient estimate. This is consistent with the expectation that livestock sales during years with poor rains and harvests are often driven by the need to purchase food off the market. It is also consistent with

[56] Given the relatively low control over fertility in this context, it is unlikely that this finding reflects higher birth rates among households less affected by the drought than others. One exception is the possibility that impacts varied by household age composition.

the qualitative data analyzed above, which showed that livestock sales were not usually among the first responses to hardship. In contrast, however, households that received loans were more likely to have experienced losses. This is also in line with the qualitative analysis above, which suggested that monetary borrowing served as a last resort.

Table 5.10 *Linear regression of drought-related change in household livestock (TLU)*

Model	1			2			3			4			5		
Variables	β		SE	β		SE	β		SE	β		SE	β		SE
Household size (start 2011)	-0.091		0.106	-0.007		0.084	-0.030		0.084	-0.022		0.082	-0.015		0.086
Housholder=female	0.491		0.468	0.188		0.371	0.151		0.377	-0.305		0.367	-0.301		0.396
Dependency ratio	0.164		0.312	-0.136		0.249	0.198		0.340	0.292		0.311	0.356		0.358
Land (start 2011, ha)	-1.278	***	0.456	0.574		0.439	0.719		0.445	0.770	*	0.419	0.811	*	0.438
Cmty lship 2010 =yes	-0.622	*	0.325	-0.271		0.260	-0.210		0.257	-0.272		0.265	-0.310		0.270
Other shocks 2010=yes	0.153		0.320	0.047		0.252	0.292		0.303	0.386		0.281	0.352		0.295
Births 2010=yes	-0.106		0.395	-0.104		0.310	-0.163		0.318	-0.074		0.288	-0.111		0.303
PSNP 2010|2011= yes	-0.198		0.276	-0.552	**	0.223	-0.407	*	0.229						
Meal freq*size 2010 (mean)	-0.061	**	0.026	-0.047	**	0.021	-0.047	*	0.023						
Livestock (start 2011, TLU)				-0.490	***	0.067	-0.465	***	0.069	-0.462	***	0.065	-0.478	***	0.071
Births 2011-13=yes							0.457		0.352	0.620	*	0.323	0.606	*	0.344
Other shocks 2011-13 =1							-0.652	**	0.317	-0.981	***	0.303	-0.933	***	0.324
=2							-0.507		0.356	-0.884	***	0.332	-0.791	**	0.357
=3							-0.707	*	0.397	-1.156	***	0.365	-1.152	***	0.386
PSNP 2012|2013=yes										-0.632	**	0.269	-0.671	**	0.293
Off-farm labor 2011-13=yes										-0.034		0.223	-0.039		0.236
Borrowed/received money 2011-13=yes										-0.767	***	0.214	-0.841	***	0.230
Food transfer in 2011-13=yes										0.683	**	0.293	0.837	**	0.322
Meal freq*size 2011-13 (mean)										-0.039		0.025	-0.035		0.026
_cons	1.522	*	0.881	1.605	**	0.693	1.477	*	0.792	1.610	**	0.763	1.470	*	0.792
N	95			95			95			95			87		
R-squared	0.236			0.533			0.57			0.655			0.647		

*p<0.10 **p<0.05 ***p<0.01

Source: Kejima Household Survey

The results in Model 5 indicate that the estimates in Model 4 are robust to excluding those without any livestock in 2011. This set of findings is also robust to changes in the measurement of household livestock holdings from TLUs (Table 5.10) to respondent-reported prices (Table 5.11). The only difference between these two series of models is that pre-drought community leadership is associated with large (negative) drought impacts in three of the price-weighted models (#1, #4, #5). Households with at least one member in a community leadership position(s) may have been more likely to be subjected to claims from other community members (e.g., requests for good) during periods of environment stress. Of course, these results should be

interpreted with caution. The community leadership variable was significant at only marginal levels of statistical significance in the three abovementioned models. Further, it was non-significant in Models #2 and #3, which are the most complete models without the almost-certainly endogenous behavioral response variables included.

Table 5.11 *Linear regression of drought-related change in household livestock (price)*

Model	1			2			3			4			5		
Variables	β		SE	β		SE	β		SE	β		SE	β		SE
Household size (start 2011)	-677.93		643.53	-194.23		573.41	-304.36		580.78	-343.00		567.01	-232.03		586.46
Housholder=female	4317.01		2855.64	2681.01		2529.87	2346.39		2598.59	-969.44		2534.86	-450.40		2694.44
Dependency ratio	1083.40		1905.21	-690.54		1709.94	954.33		2339.97	1427.24		2148.25	1522.11		2425.56
Land (start 2011, ha)	-3204.44		2779.36	5856.11	*	3019.11	6590.60	**	3100.25	7205.81	**	2920.57	7278.06	**	3012.96
Cmty lship 2010 =yes	-3824.14	*	1981.32	-2428.42		1762.49	-2055.34		1765.22	-3049.98	*	1812.54	-3334.19	*	1818.44
Other shocks 2010=yes	937.96		1949.10	103.10		1720.62	1331.99		2086.53	2010.21		1937.10	1446.17		2000.03
Births 2010=yes	384.95		2405.86	424.78		2114.24	202.83		2192.26	909.68		1988.42	893.72		2053.46
PSNP 2010|2011= yes	-2139.24		1684.90	-3553.22	**	1506.34	-2719.00	*	1564.67						
Meal freq*size 2010 (mean)	-376.33	**	159.34	-314.68	**	140.55	-320.08	*	162.23						
Livestock (start 2011, price)				-0.46	***	0.09	-0.43	***	0.09	-0.41	***	0.09	-0.42	***	0.10
Births 2011-13=yes							2173.19		2408.23	3223.22		2212.34	3132.86		2315.71
Other shocks 2011-13 =1							-4241.57	*	2197.61	-6571.22	***	2096.53	-6148.79	***	2205.25
=2							-3445.36		2456.60	-5901.81	**	2289.45	-5293.84	**	2421.94
=3							-3904.59		2736.84	-6946.04	***	2520.91	-7025.62	***	2620.18
PSNP 2012|2013=yes										-4820.29	**	1855.47	-5191.33	**	1989.58
Off-farm labor 2011-13=yes										437.81		1539.36	583.82		1597.44
Borrowed/received money 2011-13=yes										-4937.18	***	1479.36	-5262.12	***	1563.26
Food transfer in 2011-13=yes										5601.17	***	2009.05	6619.64	***	2173.67
Meal freq*size 2011-13 (mean)										-282.92		176.56	-256.16		178.63
_cons	8693.00		5369.11	9205.67	*	4719.36	9123.04	*	5450.72	10388.39	*	5261.23	9172.46	*	5365.53
N	95			95			95			95			87		
R-squared	0.171			0.367			0.404			0.521			0.521		

*p<0.10 **p<0.05 ***p<0.01

Source: Kejima Household Survey

Assets

The final two sets of models predict rainfall deficit-associated changes in household assets, which descriptive statistics indicated were on average positive but incremental. That is, households tended to accumulate assets at a slightly higher rate between 2011 and May 2013 relative to the 2010-2011 period. The first set of models predicts changes in total household assets, weighted with respondent-reported prices (Table 5.12). The results indicate that asset accumulation is strongly tied to the size of baseline household land holdings. Those with more

land in 2011 were likely to preserve or increase their asset holdings during years with rain deficits. This is consistent with the reported estimates with respect to livestock losses (Tables 5.11), and the more general interpretation that household vulnerability to shocks is inversely related to land ownership.

Table 5.12 *Linear regression of drought-related change in household assets (price)*

Model	1			2			3			4			5		
Variables	β		SE	β		SE	β		SE	β		SE	β		SE
Household size (start 2011)	-103.53		321.82	-26.44		323.22	-43.32		330.08	39.94		356.83	151.06		403.81
Housholder=female	-1179.45		1428.05	-1047.76		1419.41	-1469.80		1470.98	-2226.58		1622.65	-2806.02		1790.08
Dependency ratio	944.89		952.76	933.05		945.29	1222.06		1289.18	1464.64		1346.41	1572.70		1799.79
Land (start 2011, ha)	4512.45	***	1389.91	5616.98	***	1555.60	6160.18	***	1599.02	6144.50	***	1807.93	7481.41	***	2063.41
Cmty lship 2010 =yes	223.73		990.82	684.94		1027.97	870.47		1037.17	1262.05		1159.74	1441.86		1374.61
Other shocks 2010=yes	-524.07		974.71	-589.60		967.98	125.07		1202.05	329.99		1262.31	187.54		1440.05
Births 2010=yes	-768.12		1203.12	-760.89		1193.66	-743.64		1247.41	-1209.05		1280.96	-1593.76		1434.10
PSNP 2010|2011= yes	573.27		842.59	433.45		840.91	853.93		885.72						
Meal freq*size 2010 (mean)	-202.25	**	79.68	-206.72	**	79.11	-195.72	**	92.37						
Assets (start 2011, price)				-0.66		0.43	-0.59		0.44	-0.66		0.46	-1.07	*	0.54
Births 2011-13=yes							305.34		1354.73	495.71		1411.37	516.13		1776.68
Other shocks 2011-13 =1							-2109.92	*	1238.74	-2199.31		1339.89	-3875.90	**	1780.93
=2							-1985.19		1390.15	-2539.86	*	1472.52	-4239.73	**	1942.00
=3							-2256.84		1581.87	-2876.59	*	1647.64	-4367.80	**	2014.91
PSNP 2012|2013=yes										614.50		1209.19	476.66		1539.92
Off-farm labor 2011-13=yes										647.14		1007.01	743.61		1221.63
Borrowed/received money 2011-13=yes										-1560.40		940.34	-1687.37		1165.53
Food transfer in 2011-13=yes										-182.75		1262.49	-426.04		1573.48
Meal freq*size 2011-13 (mean)										-85.15		114.43	-102.89		127.34
_cons	1557.74		2684.99	1153.49		2676.86	1666.22		3106.72	-39.59		3388.95	989.72		4168.42
N	95			95			95			95			78		
R-squared	0.213			0.234			0.267			0.245			0.31		

*p<0.10 **p<0.05 ***p<0.01

Source: Kejima Household Survey

Unexpectedly, pre-drought food security is associated with drought-related declines in household assets in the first two models. The magnitude of these effects is incremental, however. Moreover, in subsequent models with additional controls, average food security during years with rainfall deficits (2011-2013) is non-significant. Recalling that these two measures of food security—before and during the drought—are highly correlated, the significant effect observed in the first two models likely reflects confounding influences from the other covariates introduced in Model 3 and 4. These subsequent models also indicate that, as expected, exposure to other shocks during the 2011-2013 period was associated with asset losses. Asset holdings in 2011

were negatively associated with higher rates of asset accumulation over the 2011-2013 period (at marginal levels of statistical significance). This is consistent with the mobility tables above, which showed most changes in assets occurring among households with low levels of assets at baseline.

Table 5.13 *Linear regression of drought-related change in household assets (index)*

Model		1		2		3		4	
Variables		β	SE	β	SE	β	SE	β	SE
Household size (start 2011)		-0.013	0.036	-0.020	0.037	-0.030	0.037	-0.032	0.039
Housholder=female		-0.234	0.162	-0.244	0.161	-0.248	0.163	-0.296	0.178
Dependency ratio		0.078	0.108	0.095	0.108	0.201	0.144	0.202	0.148
Land (start 2011, ha)		-0.018	0.157	0.189	0.215	0.249	0.215	0.315	0.241
Cmty lship 2010 =yes		0.030	0.112	0.089	0.119	0.102	0.117	0.113	0.128
Other shocks 2010=yes		-0.031	0.110	-0.004	0.111	0.033	0.132	0.043	0.137
Births 2010=yes		-0.080	0.136	-0.074	0.135	-0.076	0.139	-0.095	0.141
PSNP 2010|2011= yes		-0.022	0.095	0.003	0.097	0.033	0.098		
Meal freq*size 2010 (mean)		-0.011	0.009	-0.006	0.010	-0.012	0.011		
Assets (start 2011, index)				-0.112	0.080	-0.091	0.083	-0.119	0.089
Births 2011-13=yes						0.174	0.151	0.179	0.155
Other shocks 2011-13	=1					-0.299 **	0.140	-0.295 **	0.148
	=2					-0.092	0.161	-0.082	0.171
	=3					-0.190	0.181	-0.191	0.189
PSNP 2012|2013=yes								0.027	0.131
Off-farm labor 2011-13=yes								0.085	0.114
Borrowed/received money 2011-13=yes								-0.067	0.104
Food transfer in 2011-13=yes								-0.025	0.139
Meal freq*size 2011-13 (mean)								-0.009	0.013
_cons		0.518 *	0.304	0.438	0.308	0.517	0.348	0.462	0.375
N		95		95		95		95	
R-squared		0.061		0.082		0.153		0.151	

*p<0.10 **p<0.05 ***p<0.01

Source: Kejima Household Survey

The final set of models predicts rainfall deficit-related changes in household asset wealth scores estimated using the factor analytic techniques previously described (Table 5.13). Although the directions of the coefficients in these models are largely consistent with the results in the price-weighted model, only the effect of exposure to other shocks during 2011-2013 is statistically significant. The lack of statistically significant findings in this model is not surprising given the limited variance of households' wealth index scores, which is a function of

how the scores are calculated (see above). Consistency in the direction of coefficient estimates between these two models (Tables 5.12 and 5.13) may nonetheless provide support for the findings in Table 5.12.

Conclusion

This chapter examined the relationship between rainfall deficits and asset and livestock inequality levels within Kejima. The results show that levels of both livestock and asset inequality—each measured using two alternative weighting schemes—observed in May 2013 were substantially lower than the level expected if inequality trends between 2010 and 2011 had continued to 2013. Assuming the absence of other confounding factors, these results indicate that exposure to rainfall deficits was associated with an equalization of livestock and asset holdings among households in Kejima.

Further, analysis of households' absolute economic mobility with respect to livestock shows that households in the two highest livestock ownership quartiles experienced the highest rates of absolute livestock loss during the drought. This indicates that the decrease in livestock inequality was driven mainly by declines among households in the upper tail of the 2011 livestock distribution. In contrast, changes in asset inequality were driven by a slightly disproportionate tendency toward asset accumulation among the most asset-poor households at the start of 2011. This likely reflects a general disconnect between non-livestock household assets and environmental conditions.

This chapter also explored the heterogeneous rainfall deficit-related changes among households in Kejima, which are the underlying driver of changes in asset and livestock inequality as measured in this analysis. Here, the results show that drought-related changes in

household livestock holdings were often significantly associated with factors hypothesized to affect vulnerability (resilience) to environmental shocks, and thus affect the likelihood that households engaged in particular types of activities in response to rainfall deficits. High odds of livestock sales and losses did not necessarily reflect high levels of vulnerability, however. For instance, the results support the claim that, all else equal, households with relatively high levels of livestock holdings are more likely to lose livestock during periods of stress than those with few. The qualitative evidence analyzed above suggests that livestock sales allow these initially better-off households to maintain relatively high levels of food consumption, maintain the ability to purchase agricultural inputs for the next growing season, and generally fare better with respect to other outcomes, relative to those with few livestock at the start of the drought. This again highlights the importance of paying close attention to the outcomes one uses to assess the impact of environmental shocks. In contrast, few hypothesized dimensions of vulnerability were significantly associated with estimated drought-associated changes in other household assets. Again, this suggests that non-livestock household asset sales played a minimal role in household responses to rainfall deficits and related crop failures.

Overall, this case study has shown that the relationship between rainfall deficits, household wealth, and social and economic inequality in Kejima is complex. Indeed, the conclusions that one draws from this case study are influenced by the outcome and temporal frame that one considers. For example, while food insecurity among the poorest households was often limited by loans and transfers from better-off households—at least during the first part of the crisis—this assistance often came with long term costs that are likely to limit recipients' odds of upward mobility. In another example, the association between rainfall deficits and equalization of household livestock wealth in Kejima seems to have largely reflected the ability

or propensity of initially better-off households to supplant their food supplies—and capacity to share or loan resources with other community members—by selling livestock. Equality in livestock assets may correspond with processes that (a) stratified the distribution of food security among households and, relatedly, (b) positioned better-off households to develop (or reinforce) social relationships with long-term advantages through lending and assistance.

Such findings underline the importance of critically examining the outcomes one utilizes when assessing the social and economic impacts of environmental shocks, and relatedly, highlights the value of mixed methods research. That said, the valuable insight gained by such case ideographic case studies comes at the expense of generalizability. I address this latter issue in the next chapter by assessing whether the observed relationships between rainfall deficits and within-community asset and livestock inequality occurred across other deficit-affected areas in rural Ethiopia.

CHAPTER 6: RAINFALL SHOCKS AND WITHIN-COMMUNITY ASSET AND LIVESTOCK INEQUALITY ACROSS RURAL ETHIOPIA: EVIDENCE FROM THE DEMOGRAPHIC AND HEALTH SURVEYS

Introduction

Evidence from this dissertation and the existing research reviewed above suggests that environmental shocks are often associated with decreased expenditures, reduced food consumption, distress sales of productive assets, and out-migration—all of which may undermine a household's long-term welfare and social standing in its community (Dercon et al. 2005, Gray and Mueller 2012a, Hoddinott 2006, Hoddinott and Kinsey 2001, Little et al. 2006). In some cases, however, the magnitude and likelihood of these negative impacts has been shown to vary within affected populations, and certain actors may even gain from such crises by exploiting the vulnerable or benefitting from changes in relative prices (De Waal 2005, Watts 2013). These heterogeneous impacts reflect systematic differences in vulnerability, which is a function of a given household's exposure to the shock and its ability to cope without compromising its long-term economic and social status (Bohle et al. 1994, Chambers 2006, Watts & Bohle 1993).

Assuming that vulnerability does indeed vary within communities, households should experience differential changes in outcomes affected by a given shock (e.g., asset sales, odds of out-migration). Such heterogeneous effects will, by definition, change the relative status, or distribution of affected households with respect to that outcome(s). Despite this seemingly straightforward expectation, no existing large-n research has examined the impact of environmental shocks on social and economic inequality within communities. These places are key loci of social and economic activity, and sites of many processes that produce, reproduce,

and change inequality. Previous studies of how environmental shocks affect household-level outcomes, or shape between-household inequality across larger geographic spaces, provide hypothesis-generating insights but ultimately cannot answer the empirical question of how heterogeneous outcomes at the micro-level contribute to changes in aggregate within-community inequality.

The analyses in previous chapters showed that rainfall deficits were associated with changes in asset and livestock inequality among households in Kejima, as well as changes in the structure of labor relations and economic opportunity more broadly. This chapter assesses whether the association between rainfall deficits and wealth inequality observed in Kejima is generalizable beyond that specific context.

As the pages above have argued, this distributional, community-level question is an important one. For one, existing research on environmental inequalities has tended to frame social inequality as an explanatory factor, rather than an outcome of environmental change (Bullard 2000, Crowder and Downey 2010). This study considers the possibility that social inequality may both contribute to differential vulnerability to environmental shocks and be produced or transformed in the aftermath of such events. Environment-related inequality dynamics also have important implications on the ground, particularly in chronically shock-affected areas. The distribution of resources within communities has been shown to affect a number of household- and community-level outcomes that are important in their own right. These include functioning of redistribution systems, social and political exclusion, and other factors that may have consequences for vulnerability to future shocks (Adger 2000, Berry 1989, Cleaver 2005, Mogues 2006, Woolcock 1998).

This chapter makes an initial contribution toward filling the gap in generalizable knowledge about the distributional impacts of environmental shocks by examining the relationship between rainfall deficits and asset inequality within rural Ethiopian communities. Drawing upon data from the 2005 and 2011 Ethiopian Demographic and Health Surveys (EHDS) and an agro-climatology dataset developed by NASA, I estimate the association between rainfall deficits and within-community asset and livestock inequality. Given the lack of previous research on this topic, I also place considerable emphasis on methodological and measurement issues that future research on this topic must engage with.

Literature review

Despite a substantial literature examining the often-adverse impacts of environmental shocks on rural households, little is known about how the effect of such events varies across households and, by extension, affects inequality in shock-affected communities. Existing studies addressed the relationship between environmental shocks and within-community inequality only tangentially, providing useful insights for developing hypotheses but leaving significant gaps in evidence.

The literature review in Chapter 1 showed that Reardon and Taylor (1999), Valentine (1993), and Fratkin and Roth (1990) explored changing between-household inequality in drought contexts, but did not consider inequality within communities or other socially and economically meaningful spaces. The findings from each were also limited by significant methodological shortcomings. Other existing studies have contributed indirectly to knowledge on this topic by considering a limited set of factors (e.g., wealth, gender) that differentiated households with respect to social, economic and demographic outcomes after environmental shocks (e.g. Carter et

al. 2007, Gray and Mueller 2012b, Gray and Bilsborrow 2013, Little et al. 2006). Together, these insightful studies generate hypotheses, but do not answer the question of how environmental shocks affect within-community inequality.

Chapter 1 also commented on this question's importance. Theoretically, it reconsiders existing approaches to environmental inequalities, and begins to show how heterogeneous micro-level behaviors contribute to changes in macro-social community structures. Such shock-related inequality dynamics are likely to have considerable social, economic, and political implications, and may affect vulnerability to future shocks. This is particularly important in areas with highly variable natural environments.

To briefly re-summarize the most relevant literature to this chapter, Reardon and Taylor (1996) found that exposure to drought was associated with household income equalization within an affected agro-climatic zone in Burkina Faso. They showed that much of the observed equalization was due to livestock sales among the poor in drought-affected areas, which offset inequality-increasing changes in crop sales and migration income.[57] Valentine (1993) found that exposure to drought was associated with only trivial changes in income inequality among households across rural Botswana. Like Reardon and Taylor, however, Valentine reported that drought was associated with significant changes in the composition of household income. Both studies show that multiple and potentially offsetting processes (e.g., livestock sales, migration and remittances) may underlie drought-related changes in income inequality. While many of these processes (e.g., livestock sales) have different implications for asset wealth than for income, these findings nonetheless demonstrate that changes in inequality may reflect processes of both asset loss and wealth or income accumulation. However, both studies are limited by

[57] It is worth emphasizing that although livestock sales among the poor offset other trends toward increased income inequality, it may contribute to long-term asset inequality.

weak or nonexistent controls for potentially confounding changes within the drought-affected areas. These analyses also measure between-household inequality across large geographic units (e.g., agro-climatic zones, rural areas) that are quite remote from the spaces in which rural households live and where most exchange between households takes place. Additionally, environmental conditions are likely to vary within larger spatial units, making it difficult to measure exposure to shocks.

Despite these methodological limitations, Reardon and Taylor and Valentine's findings about the changing composition of income sources in drought-affected contexts are consistent with other literature on household responses to environmental crisis. Corbett (1988) and De Waal (2005) documented activities that commonly occur as a part of these strategies, including: formal and informal borrowing and transfer arrangements; changes in agricultural practices; out-migration of various durations; livelihood diversification; livestock sales; and decreased food consumption. Many of these activities have consequences for households' asset stocks.[58] On the one hand, consumption smoothing behaviors involve liquidating assets, or forgoing opportunities to accumulate assets, in order to maintain adequate levels of food consumption (Morduch 1995). On the other hand, households may engage in conservative asset smoothing behaviors that entail sacrificing current consumption to protect existing asset stocks, which may be necessary to avoid complete dispossession or deal with expected future shocks in high-risk environments (Barrett and Carter 2013, Carter and Lybbert 2012, De Wall 2005, Hampshire et al. 2009, Zimmerman and Carter 2003). A number of other responses, such as out-migration of household members,

[58] Although this paper focuses explicitly on households' durable assets and livestock, previous research has shown that households also consider social assets/capital when developing coping strategies (De Waal 2005). In some cases, they may forgo consumption to protect their social standing or social relationships, while in others they may engage in socially stigmatized behavior to maintain consumption.

may affect asset stores indirectly by reducing demand for resources among household members (Ezra 2001).[59]

Ethnographic research has shown that the particular set and timing of coping strategies employed by households in drought-affected contexts is contingent upon a multiplicity of social, economic, and ecological conditions (De Waal 2005). Without dismissing these complexities, quantitative research has shown that certain types of households tend to engage in certain strategies—or experience certain outcomes—more than others. For example, Dercon et al. (2005) found that drought had a significant negative effect on consumption levels among rural Ethiopian households between 1999 and 2004.[60] These impacts varied systematically with households' social and economic statuses: female-headed households, households headed by individuals without formal education, and relatively land-poor households experienced greater drought-related declines in consumption than others. The relatively large impact among these vulnerable populations may reflect a higher propensity to sacrifice consumption to protect assets among lower-status households, who may have fewer assets to buffer against future shocks. These households may also simply lack assets to sell off or exchange for other goods. Such hypothesized behavior is consistent with the findings of Hoddinott (2006), who showed that rural Zimbabwean households with low levels of assets prior a shock were more likely to reduce food consumption than liquidate assets needed to maintain pre-shock consumption levels.[61]

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[59] Although some have classified out-migration as a consumption smoothing tactic, it may also fit into some households' risk reduction strategies (Lucas and Stark 1985, Rosenzweig and Stark 1989). I place it in a separate demand reduction category because this is the primary mechanism through which it contributes to consumption smoothing or risk reduction.

[60] These effects were often persistent: droughts that occurred between 1999 and 2001 were associated with lower consumption in 2004.

[61] Hoddinott (2006) also makes an important contribution by examining the impact of shocks among individuals within households. He finds that within households, the burden of reduced food consumption was borne almost entirely by women and children.

Little et al. (2006) also found evidence that households with relatively high levels of assets (*ex ante*) were more likely to experience shock-related decreases in assets than those with few assets. They find that many Ethiopian households classified as poor prior to a drought maintained or even accumulated assets during and after it, often by reducing consumption and engaging in wage labor or petty trade. In contrast, wealthier households experienced large proportional declines in their assets, which may reflect their relatively high levels of exposure, as well as their ability to sell assets for food without endangering their long-term social and economic standing (i.e., falling into poverty traps). Moreover, these wealthy households were able to recover many of their assets in subsequent months by taking advantage of a favorable post-drought livestock market, promoting natural herd reproduction, and engaging in exploitative herd-sharing contracts with the poor. The post-shock trajectory of the poor was relatively flat in comparison.[62]

Existing research has also shown that environmental shocks affect migration. Mobility among individuals and households may in turn shape wealth inequality in communities if migration, or remittances from migrants, occur disproportionately in particular wealth groups. Gray and Mueller (2012a) found that exposure to drought was associated with changes in geographic mobility in rural Ethiopia, but the effects were heterogeneous across different types of households. The drought effect was particularly large among land-poor men and women in female-headed households; and relatively small among women with children and women living in a household with a socially important head.[63] Gray and Mueller also explored the effect of drought on particular types of migration, finding that it was associated with increased long-

[62] Those in poverty trap-like situations may not be 'responsive' to shocks in terms of observed outcomes (e.g., assets). This may reflect their relatively low exposure to the shock, as well as the relatively incremental differences between 'normal' and 'shock' years for those in chronic poverty.

[63] The effect of drought on migration also varies according to age for both men and women, suggesting that unobserved factors related to the life course may affect drought-related mobility.

distance migration and labor mobility among males. This suggests that households may use migration as a means of supplementing household income or reducing demand on household food supplies during drought. In contrast, drought conditions were associated with decreased likelihood of female marriage-related migration, likely reflecting aversion to paying potentially high bride prices during periods of environmental and economic stress. Gray and Bilsborrow (2013) also found evidence of heterogeneous odds of out-migration in response to environmental changes in the case of Ecuador. These and other instances of selective demographic responses to environmental shocks have clear, if understudied implications for inequality within affected communities.

To recap, existing research on the social and economic impacts of environmental shocks suggests that many outcomes vary systematically across different types of households, often reflecting underlying disparities in vulnerability. With respect to household assets, these studies suggest that better-off households (e.g., asset-rich, socially important) are more likely to liquidate assets than diminish consumption, or cope *in situ* rather than engage in labor-related out-migration. In contrast, poor or socially marginal households may be more likely to protect current and future assets by reducing consumption, or sending household members away to engage in wage labor and/or reduce resource demands in the household.

Given these differential tendencies, one would expect environmental shocks to have an equalizing effect on between-household asset inequality in affected communities. One would further expect this hypothesized equalization of asset ownership to be driven by decreasing asset levels among households in the upper tail of the asset distribution, rather than an increase in asset levels among households in the lower tail. However, these expectations are complicated by two additional observations. Given the positive correlation between wealth and land size in the rural

Ethiopian context, asset-rich households may obtain more agricultural production during periods of environmental stress than asset-poor households (Dercon et al. 2005). Assuming a uniform reduction in per unit crop yields across households, those with the largest landholdings should still realize the largest absolute levels of production, and presumably face less economic stress and food insecurity than others. However, wealthier household are also likely to be subject to claims for social transfers during periods of stress, while worse-off households are more likely to receive them (Webb and Reardon 1992). Such redistributive processes may mitigate or offset the expected behaviors outlined above.

Given these potentially offsetting theoretical expectations, the relationship between rainfall shocks and within-community wealth inequality remains an empirical question—and one that has not been addressed to date. This chapter represents an initial contribution to quantitative evidence on this topic. Its main objective is to estimate the statistical relationship between exposure to rainfall deficits and within-community asset and livestock inequality, respectively. With a lack of previous research on this particular question, a secondary but nonetheless important objective of this chapter is to discuss the challenges and limitations encountered in the current analysis, and identify directions for future research.

Data

This study utilizes data from the 2005 and 2011 EDHS, and NASA's POWER project (described in Chapter 5). The EDHS is one of many surveys implemented across the developing world as a part of the Demographic and Health Survey (DHS) Program. The primary purpose of this program is to collect data about population dynamics, health, and nutrition in low and lower-middle income countries. Given the scope of the data collected through these surveys, however,

the DHS provides a valuable source of information to examine questions beyond these topics. In fact, wealth and inequality have been the focus of previous research using the DHS (Sahn and Stifel 2000, Sahn and Stifel 2003).

The EDHS includes data for a large number of communities across Ethiopia, a requisite for studying community-level outcomes. These data are representative at the national and regional levels, and for urban and rural areas (Central Statistical Agency and ORC Macro 2006, Central Statistical Agency and ICF International 2012). EDHS data were collected using a stratified two-stage sampling strategy. In the first stage, a sample of enumeration areas[64] (EA) was drawn from a population of EAs defined by the most recent Population and Housing Census (PHC) prior to each survey. Selection was stratified according to region and rural (urban) status. In the second stage, 30 households were sampled from each selected EA and interviewed. As a repeated cross-sectional survey, no communities or households were purposely selected in both 2005 and 2011.

The EDHS includes data on household assets and livestock holdings, which I use to estimate within-community wealth inequality. Importantly, the EDHS also collects latitude and longitude coordinates for all EAs in the sample.[65] Using these geocodes, I link agro-climatic data from NASA's POWER project to each EA observed in the 2005 and 2011 EDHS. As previously discussed, the POWER data—specifically, data from the MERRA project—include daily

[64] EAs are geographically small counting areas that represent entirely rural or urban areas within *woredas* (county equivalents in Ethiopia). Among the EAs created for the 2007 Ethiopian Population and Housing Census, the average size of rural EAs ranged from 129-233 across the eleven regions of Ethiopia. Practically, EAs are appropriate units for measuring intra-community asset inequality in rural areas, since most rural households' economic interactions are likely to take place within the few villages in each EA. The social significance of EAs in urban areas is far more ambiguous, but these areas are excluded from the study.

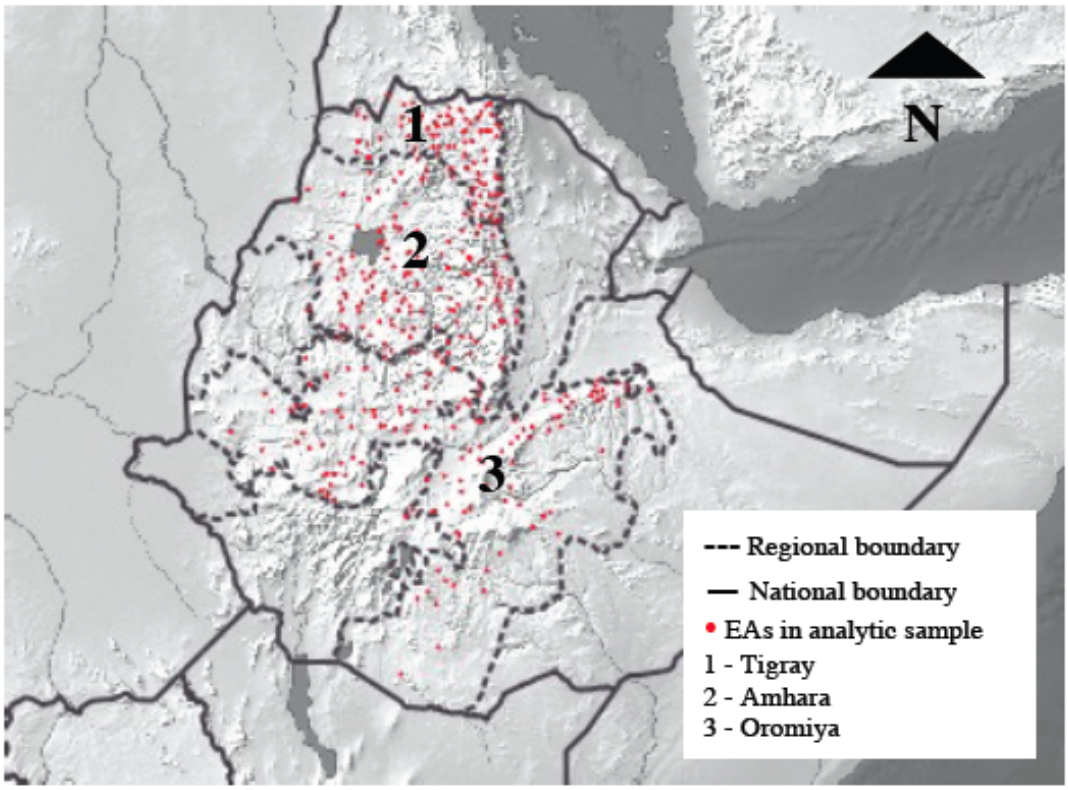
[65] To maintain respondent confidentiality, the latitude/longitude positions of published DHS data are randomly displaced. The DHS geocodes contain between 0-2 km of error for urban clusters and 0-5 km of error for rural areas, with 1% of rural clusters displaced by up to 10 km. This displacement is limited so that the published DHS geocodes stay within the country and within the EDHS regional sampling stratum.

average precipitation estimates from 1984 to the present[66] (with a two-month delay), with global coverage at 0.5° of resolution (see above). As such, these data can be used to identify long-term trends and short-term deviations in precipitation for relatively small geographic areas.[67] Data from the POWER project have been used in previous social science research on the effects of weather shocks (e.g., Gray and Mueller 2012a, Hirvonen, 2014, Mueller 2014).

I restrict the analysis to rural EAs, where households are largely dependent upon rainfall to support agriculture and livestock rearing for food and income. The link between urban livelihoods and local rainfall deficits is far more ambiguous. Among rural EAs, I consider only those from Tigray, Amhara, and Oromiya. Combined, these three regions span the length of the country (Map 6.1), and are home to a majority of rural Ethiopians. Relative to many other parts of the country, Tigray, Amhara, and Oromiya constitute a relatively homogenous area with respect to agro-ecology. The vast majority of the area in these regions is located at relatively high elevations (>1,000 meters), where sedentary agricultural livelihoods predominate. With the exception of far eastern Oromiya, the study area is home to almost exclusively sedentary cereal farmers (e.g., maize, barley, teff). Most households in these regions also own livestock, which provide sources of food, income, wealth, and prestige (Livelihoods Integration Unit 2010). Further, Tigray, Amhara, and Oromiya are the only regions with a sufficient number of EAs observed in the EDHS to permit the region-specific estimates needed to satisfy the assumptions of the analytical technique used below.

[66] The rainfall data used in this analysis include daily observations from January 1984 through the end of 2011.

[67] Some have suggested that it is inappropriate to merge the POWER data with the EDHS given the random displacement of published EDHS geocodes. However, we note that the EDHS displacement is relatively minor relative to the degree of resolution available with the POWER data. Moreover, substantively we are attempting to capture processes (long-term trends in rainfall and annual or monthly deviations from that trend) that, on average, are unlikely to vary significantly across 5-10 km areas.



Map 6.1: *EAs in analytic sample with national and regional boundaries*

I also restrict the sample by dropping observations of EAs that experienced abnormally high rainfall during the three full years prior to the 2011 EDHS (2008-2010).[68] As a result, I am able to construct a control group that represents areas that experienced only normal or near-normal rainfall. Finally, I exclude a limited number of additional cases because of unavailable geocodes, missing asset data, and insufficient household-level observations within the EA.[69,70]

[68] I drop all cases whose maximum annual rainfall surplus (i.e., above normal) between 2008-2010 is at or above the 75th percentile.

[69] Geocodes were unavailable for 6 EAs in 2000 (none in 2011). All households were missing data for at least one asset variable in 8 EAs in the EDHS 2005 (none in 2011). There were less than 10 household observations in 36 EAs for 2005 and 12 EAs in 2011.

[70] To examine whether the EAs included in the analytic sample have a sufficient number of household observations to reliably estimate inequality, I draw a sample of 20 EAs, and from each draw 30 bootstrap samples of households (i.e., resample with replacement). I then estimate H with respect to livestock for each bootstrap sample, and calculate the mean and standard deviation of the 30 bootstrap estimates of H for each EA, and compare with the H observed using the original EDHS data. Across all 20 of the selected EAs, the mean H from the bootstrap samples was, on average, 0.0169 more than the observed H. The average standard deviation of the bootstrap samples was 0.0518. Both figures are lower in magnitude than the observed effect of rainfall deficits (≈0.070). With respect to these estimates, also note that the analysis estimates difference between the mean level of within-community

After making these adjustments, the analytic sample includes 158 EA observations from the 2005 EDHS, and 154 EA observations from 2011 (Table 6.1).

Table 6.1 *Distribution of EAs, by region*

	2005 EDHS	2011 EDHS
Tigray	37	47
Amhara	63	53
Oromiya	58	54
Total	158	154

Source: EDHS

Together, the EDHS and POWER project provide among the best available data for the purposes of this study. For one, the EDHS includes sufficient data on household assets and livestock holdings to estimate household wealth levels, the basis for calculating inequality indices. Second, the size and representativeness of the community sample facilitates comparison of community-level inequality trends between areas affected and not affected by rainfall deficits. Third, the ability to combine point rainfall estimates from the POWER data with geographic information available for each EA in the EDHS allows for relatively precise estimation of rainfall deficits. Finally, the length of the inter-survey period (2005-2011) is sufficient to capture exposure to rainfall shocks without extensive periods of time between these events and EDHS observations.

Yet, these data are not without their limitations. Since the EDHS data were collected as repeated cross sections, it is possible that observed differences in inequality reflect compositional differences between the 2005 and 2011 samples rather than substantive changes in the underlying populations. I limit this possibility by restricting the analysis to regions with relatively large sample sizes after restrictions on the analytical sample are imposed, but a non-

inequality in drought affected and non-affected areas, rather than particular communities (see Section 5: Analytic Strategy). This may diminish the influence of estimates from any single community on overall impact estimates.

zero degree of uncertainty remains. Second, the small number of EAs observed in the other regions of Ethiopia (i.e., not included in the analytic sample) precludes a truly nationwide analysis, and prevents potentially insightful comparisons between agro-ecological or livelihoods zones. As I discuss in the concluding section, these limitations should motivate future data collection efforts.

Measurement

With respect to measurement, the first step is simply to identify and define a specific shock or set of shocks to consider. The previous research motivating this study focuses almost exclusively on drought, so I focus this analysis on rainfall deficits. Among previous studies, some have measured drought using absolute or percent deviations from the long-term mean annual rainfall (e.g. Dercon and Krishnan 2000). However, such measures are not appropriate when considering multiple communities with markedly different long-term means, as is the case in this chapter. The agricultural impact of a given absolute deviation is likely to vary by the baseline mean; and percentage deviations are in part a function of the baseline mean as well. Others studies have developed rainfall indices for specific months of the year (i.e., a typical rainy season) (e.g., Gray and Mueller 2012a).[71] This is a useful approach for analyses of areas with similar intra-annual rainfall distributions, but the normal timing and duration of the rainy season(s) varies markedly within the study area. As a result, no single subset of months is appropriate for measuring drought across the entire analytic sample.

[71]A number of other existing studies rely upon self-reported exposure to drought, which is collected in the frequently-used Ethiopian Rural Household Survey (ERHS) (e.g., Dercon et al. 2005; Dercon and Krishnan 2000, Demeke et al. 2011, Gray and Mueller 2012a. For example, Demeke et al. (2011) create a "rainfall index" based upon respondents' descriptions of the timing and amount of rainfall during the previous agricultural season. Gray and Mueller (2012a) and Dercon and Krishnan (2000) also use indicators based on self-reported experience with rainfall shocks. Data for self-reported exposure to rainfall shocks was not available in the EDHS, and other studies have suggested that such reports may not be reliable (Meze-Hausken 2004).

As an alternative to previous approaches, I use the standardized deviation (i.e., *z*-score) of each location's observed annual rainfall from the long-term mean annual rainfall for that location.[72] The focus on annual rainfall is appropriate given variation in the normal timing of rainfall within the study area. However, it comes at the expense of information on the timing of rainfall (and rainfall deficits) within years. *Z*-scores are comparable across communities with different long-term means, and also account for differences in long-term variance in annual rainfall by expressing the magnitude of a given rainfall deficit in terms of standard deviations. That is, areas that commonly experience year-to-year shifts in annual rainfall are not necessarily more likely to be classified as drought-affected than others since the *z*-score captures the extent to which a given rainfall deficit is outside of the typical long-term range for that community.

Table 6.2 *Distribution of EAs, by largest annual rainfall deficit 2008-2010*

Standardized deviation (z) of annual rainfall, 2008-2010	2005 EDHS			2011 EDHS		
	Tigray	*Amhara*	*Oromiya*	*Tigray*	*Amhara*	*Oromiya*
z≥0	8	25	23	12	23	21
0<z≤(-)0.25	4	5	4	4	3	8
(-)0.25<z≤(-)0.5	3	9	10	4	6	6
(-)0.5<z≤(-)0.75	0	2	8	1	1	4
z<(-)0.75	22	22	13	26	20	15
Total	37	63	58	47	53	54

Source: EDHS & NASA-POWER

Using this relative measure of rainfall deficit, I assign locations' drought status by defining two additional parameters: (1) the *z*-score threshold at which a rainfall deficit is considered a drought; and (2) the year or years in which experiencing a given rainfall deficit is considered exposure (or treatment) in the analysis. I utilize four thresholds to identify drought-affected areas: $z = 0$, $z = -0.25$, $z = -0.50$, $z = -0.75$. Although such thresholds may be considered

[72] See footnote #13 for the range of data used to calculate long-term means.

relatively high (i.e. close to $z = 0$) for normally distributed phenomena, deficits during the 2008-2010 period were rather uniformly distributed between $z = 0$ and $z = -0.75$ (Table 6.2). The clustering at the extreme high and low z-values is partially an artifact of the grouping scheme imposed on the data.

With respect to the time frame for measuring exposure, I assign drought status according to the largest negative deviation in annual rainfall observed from 2008 through 2010. Using a $z = -0.25$ threshold, for example, an area is considered drought-affected if it experienced annual rainfall of less than or equal to $z = -0.25$ in 2008, 2009, or 2010. This approach is appropriate for the timing of the EDHS surveys. Recalling that the pre-shock observation occurred in 2005 (t_1) and the post-shock observation in 2011 (t_2), this approach assigns drought status to areas that experienced at least one rainfall deficit at or below the given rainfall threshold during the three full calendar years prior to t_2. If there is a tendency to return to a pre-shock state, including observations from locations that experienced shocks in years t_2-2 and t_2-3 in the drought-affected group will introduce a downward bias in estimates of shocks' effect in year t_2. Unfortunately—from a purely research perspective—this question cannot be addressed in this study because few rural EAs were located in areas exposed to significant annual rainfall deficits in 2010. Instead, the vast majority of rainfall deficits observed in the 2008-2010 period occurred in 2008 and 2009 (Table 6.3). These estimates are largely consistent with research in the climatology literature (Viste et al. 2013).

I limit the control group to EAs that did not experience any rainfall deficit between 2008 and 2010. As noted before, I also drop EAs that experienced abnormally high levels of annual rainfall between 2008 and 2010. As such, the analysis compares drought-affected EAs

with EAs that experienced only average or slightly above-average annual rainfall throughout the entire 2008-2010 period.

Table 6.3 *Distribution of EAs, by largest rainfall deficit per year 2008-2010*

Standardized deviation (z) of annual rainfall, 2008-2010	2005 EDHS									2011 EDHS								
	Tigray			*Amhara*			*Oromiya*			*Tigray*			*Amhara*			*Oromiya*		
	2008	2009	2010	2008	2009	2010	2008	2009	2010	2008	2009	2010	2008	2009	2010	2008	2009	2010
z≥0	8	12	27	39	27	63	25	44	58	12	16	30	32	25	53	25	38	54
0<z≤(-)0.25	4	3	4	1	6	0	4	11	0	4	4	7	2	4	0	6	12	0
(-)0.25<z≤(-)0.5	3	0	3	0	11	0	8	3	0	4	0	4	0	7	0	4	4	0
(-)0.5<z≤(-)0.75	0	0	2	2	8	0	8	0	0	1	1	3	1	6	0	4	0	0
z<(-)0.75	22	22	1	21	11	0	13	0	0	26	26	3	18	11	0	15	0	0

Source: EDHS & NASA-POWER

The second measurement challenge is to adequately quantify between-household asset and livestock inequality within the observed communities. With respect to defining assets, I utilize available DHS data on household assets and livestock. I treat livestock as a separate category because of their unique social and economic value in the Ethiopian context.[73] I consider radios, televisions, phones, mobile phones, watches, tables, chairs, beds, lamps, refrigerators, bicycles, carts, motorbikes, cars, and housing materials as household assets. For livestock, I consider the cattle, horses, camels, goats, sheep, and chicken that households reported owning at the time of the survey.

Market prices are obvious solution to the weighting problem in some cases, as the case study demonstrated. However, prices vary—sometimes markedly—across rural Ethiopia, as well as across time. Given this study's relatively broad geographic and temporal scope, it is therefore difficult to construct and justify price-based weights. Instead, I use only Tropical Livestock Units (TLUs) to weight livestock (see Chapter 5). Using weights for North Africa, I weight cattle as 0.7 TLU, horses as 0.4 TLU, camels as 0.75 TLU, goats and sheep as 0.1 TLU, and chickens as

[73] Previous studies (e.g., Little et al. 2006, Mogues 2006) of wealth dynamic in Ethiopia have distinguished between livestock and other assets, usually focusing on the former.

0.01 TLU. No such weights exist for household assets (McKenzie 2010, Montgomery et al. 2000). Rather than apply simple counts or arbitrary weights, I again follow Sahn and Stifel's (2000) factor analytic approach (see Chapter 5), but here re-centered by +1.0 to facilitate inequality measurement. Using the resulting household asset and livestock estimates, I once again calculate within-community asset and livestock inequality using the Theil index. Recall that a Theil index value of 0 indicates perfect equality, with inequality increasing as values approach 1.

Analytic strategy

The exogenous placement of rainfall deficits across communities in the study area provides a natural experiment for examining the relationship between rainfall deficits and changes in inequality. Communities are presumably neither targeted, nor self-select into drought-affected areas, so baseline levels and secular trends in inequality should not vary systematically with drought exposure. If these conditions hold, one can draw inferences about the effect of drought on inequality by comparing drought-affected (i.e., treatment) and non-affected (i.e., control) areas in a manner similar to traditional experimental research.

Specifically, I utilize a difference-in-differences approach to estimate the between-subjects effect of exposure to drought. This method provides a more robust estimate of the impact of drought on inequality than within-subjects, pre/post comparisons given certain assumptions. One must assume that treatment is exogenous, and inequality trends in the treatment and control groups would follow parallel tracks in the absence of the observed rainfall shocks. For this assumption to be viable, I extend the basic difference-in-differences model to obtain so-called triple-difference estimates. These estimates account for potential regional

differences in secular inequality trends, as well as potential heterogeneity in the effect of rainfall shocks on inequality across the three regions.

I use a linear regression framework to calculate the triple-difference estimates. This can be expressed formally as:

$$Y_{ikjt} = \alpha + \beta_1 T_i + \beta_2 A_k + \beta_3 O_j + \beta_4 P_t + \beta_5 A_k P_t + \beta_6 O_j P_t + \beta_7 A_k T_i + \beta_8 O_j T_i + \delta P_t T_i + \theta_1 P_t T_i A_k + \theta_2 P_t T_i O_j + \varepsilon$$

where the outcome Y_{ikmt} is the asset or livestock inequality index for a given community; T is a dummy variable indicating the community's drought (treatment) status (reference = no drought/control); P is a dummy variable indicating the year of observation (reference = 2005); and A_k and O_j represent a pair of dummy variables that indicate whether the community is located in Amhara or Oromiya, respectively (reference = Tigray). δ, θ_1, and θ_2 are the primary coefficient estimates of interest. δ represents the mean effect of rainfall deficits on within-community inequality across the sample area, net of region-specific effects; and θ_1 and θ_2 represent the estimated differences in this effect between Tigray and the other two regions, respectively. Therefore, the estimated effect of rainfall deficits on within-community inequality is δ in Tigray, $\delta + \theta_1$ in Amhara, and $\delta + \theta_2$ in Oromiya. Here, it is worth reiterating that EDHS data were collected using repeated cross-sectional samples. This analysis therefore measures mean within-community inequality in treatment and control *areas* in both 2005 and 2011; and quantifies the change in mean within-community inequality in treatment *areas* that can be attributable to rainfall deficits (Lee & Kang, 2006).

Results

Descriptive statistics

I begin by describing inequality levels and trends across all communities in rural Tigray, Amhara, and Oromiya. The Theil Indices presented in Table 6.4 show that, on average, within-community asset and livestock inequality was extremely low across the study regions. Asset inequality was particularly low (below 0.10), but increased at a slightly higher rate than livestock inequality between 2005 and 2011.

Table 6.4 *Summary of within-community inequality*

	Asset inequality		Livestock inequality	
	Mean	*SD*	*Mean*	*SD*
2005 EDHS	0.0434	0.0197	0.1159	0.0573
2011 EDHS	0.0575	0.0206	0.1191	0.0747
	t = -6.19 (p=0.000)		t = -0.43 (p=0.669)	

Source: EDHS

Table 6.5 *Summary of within-community inequality, by region*

	Asset inequality					
	Tigray		Amhara		Oromiya	
	Mean	*SD*	*Mean*	*SD*	*Mean*	*SD*
2005 EDHS	0.0448	0.0227	0.0459	0.0175	0.0397	0.0199
2011 EDHS	0.0592	0.0216	0.0623	0.0211	0.0513	0.0177
	t = -2.96 (p=0.004)		t = -4.58 (p=0.000)		t = -3.26 (p=0.002)	
	Livestock inequality					
	Tigray		Amhara		Oromiya	
	Mean	*SD*	*Mean*	*SD*	*Mean*	*SD*
2005 EDHS	0.1109	0.0433	0.1063	0.0464	0.1294	0.0722
2011 EDHS	0.1145	0.0578	0.1048	0.0564	0.1371	0.0976
	t = -0.32 (p=0.751)		t = 0.16 (p=0.874)		t = -0.47 (p=0.637)	

Source: EDHS

Small but notable differences in inequality levels and trends were present across the three regions (Table 6.5). In both years, asset inequality was highest in Amhara and lowest in Oromiya. In contrast, livestock inequality was highest in Oromiya and lowest in Amhara—again in both

years. Both livestock and asset inequality increased slightly in all regions between 2005 and 2011, with the exception of livestock inequality in Amhara.

Impact estimates

The results of the triple-difference estimation are shown in Tables 6.6 and 6.7. The estimates in these tables indicate whether rainfall deficits had a significant effect on within-community asset (Table 6.6) and livestock (Table 6.7) inequality, and whether these effects varied by region. The results suggest that within-community asset inequality was not affected by rainfall deficits of any magnitude. This is not necessarily surprising, since few of the assets used to construct the wealth index are commonly sold as a part of coping strategies.

Table 6.6 *Estimated effect of rainfall deficit on within-community asset inequality*

Model	Treatment	Control		Coeff.	SE	t	p	N	R^2
			δ	-0.010	0.010	-0.950	0.340		
1	z<0.0	z≥0.0	θ, Amhara	0.013	0.013	1.040	0.301	312	0.1792
			θ, Oromiya	0.015	0.013	1.150	0.253		
			δ	-0.012	0.010	-1.170	0.244		
2	z<(-)0.25	z≥0.0	θ, Amhara	0.016	0.013	1.260	0.208	284	0.2101
			θ, Oromiya	0.018	0.013	1.360	0.174		
			δ	-0.012	0.010	-1.100	0.271		
3	z<(-)0.5	z≥0.0	θ, Amhara	0.015	0.013	1.160	0.248	246	0.2121
			θ, Oromiya	0.016	0.013	1.220	0.223		
			δ	-0.011	0.011	-1.080	0.282		
4	z<(-)0.75	z≥0.0	θ, Amhara	0.016	0.013	1.160	0.246	230	0.2080
			θ, Oromiya	0.020	0.014	1.390	0.166		

**p<0.10 **p<0.05 ***p<0.001*

Source: EDHS & NASA-POWER

However, sales and slaughter of livestock, and livestock mortality are quite common, and as expected, many of the estimates in Table 6.7 are statistically significant. Model 1 shows that

mean within-community livestock inequality was significantly lower in areas that experienced any rainfall deficit (z<0.0) between 2008 and 2010 than in areas that experienced only normal or slightly above-normal rainfall during these years. Differences in this effect between Tigray and Amhara were marginally significant (p=0.094) and suggest that rainfall deficits had only a trivial effect on livestock inequality in Amhara ([δ = -0.076] + [θ_1 = 0.071] = -0.005). The results from this initial model are generally robust to different definitions of drought, specifically z = -0.25 (Model 2), z = -0.50 (Model 3), and z = -0.75 (Model 4). This set of estimates supports two conclusions. First, rainfall deficits have a strong negative effect on average levels of within-community livestock inequality in Tigray. Second, the estimated effect of rainfall deficits in Amhara and Oromiya differs from that in Tigray at marginal levels of statistical significance. In comparison to the equalizing effect observed in Tigray, the estimated effect in these two regions may not be statistically different from zero.

Table 6.7 *Estimated effect of rainfall deficit on within-community livestock inequality*

Model	Treatment	Control		Coeff.	SE	t	p		N	R^2
			δ	-0.076	0.034	-2.23	0.027	**		
1	z<0.0	z≥0.0	θ, Amhara	0.071	0.042	1.68	0.094	*	312	0.0583
			θ, Oromiya	0.066	0.043	1.56	0.120			
			δ	-0.077	0.034	-2.26	0.025	**		
2	z<(-)0.25	z≥0.0	θ, Amhara	0.076	0.042	1.81	0.071	*	284	0.0601
			θ, Oromiya	0.071	0.043	1.65	0.100			
			δ	-0.073	0.036	-2.04	0.043	**		
3	z<(-)0.5	z≥0.0	θ, Amhara	0.074	0.045	1.63	0.105		246	0.0558
			θ, Oromiya	0.058	0.046	1.25	0.213			
			δ	-0.072	0.036	-1.99	0.048	*		
4	z<(-)0.75	z≥0.0	θ, Amhara	0.072	0.046	1.58	0.115		230	0.0559
			θ, Oromiya	0.078	0.048	1.61	0.109			

**p<0.10 **p<0.05 ***p<0.001*

Source: EDHS & NASA-POWER

To better evaluate the between-region differences observed in the triple-difference estimates calculated above, I calculate difference-in-differences estimates for each region using the same set of definitions for treatment and control groups as Models 2-4 above. That is, for each region I compare changes in mean levels of inequality in areas affected by drought with changes in non-affected area. These region-specific estimates (Table 6.8) confirm that rainfall deficits had significant negative effects in Tigray, with coefficient estimates ranging from -0.072 to -0.077. Recalling that, with respect to livestock inequality, the mean value of *H* among communities in Tigray was 0.1109 in 2005, the estimated effect of drought represents more than 60% of baseline inequality.

Table 6.8 *Estimated effect of rainfall deficit on within-community livestock inequality, select models by region*

Region	Model	Treatment	Control	Coeff.	SE	t	p		N	R^2
	1	z<(-)0.25	z≥0.0	-0.077	0.026	-2.92	0.005	**	76	0.1123
Tigray	2	z<(-)0.5	z≥0.0	-0.073	0.028	-2.64	0.010	**	69	0.1066
	3	z<(-)0.75	z≥0.0	-0.072	0.028	-2.57	0.012	**	68	0.1048
	1	z<(-)0.25	z≥0.0	-0.001	0.020	-0.03	0.973		108	0.0016
Amhara	2	z<(-)0.5	z≥0.0	0.001	0.023	0.04	0.972		93	0.0003
	3	z<(-)0.75	z≥0.0	0.001	0.023	0.03	0.977		90	0.0003
	1	z<(-)0.25	z≥0.0	-0.007	0.034	-0.19	0.847		100	0.0204
Oromiya	2	z<(-)0.5	z≥0.0	-0.015	0.038	-0.40	0.689		84	0.0206
	3	z<(-)0.75	z≥0.0	0.006	0.043	0.14	0.886		72	0.0342

**p<0.10 **p<0.05 ***p<0.001*

Source: EDHS & NASA-POWER

The results in Table 6.8 provide additional evidence that the association between rainfall deficits and livestock inequality was non-significant in Amhara and Oromiya. However, it is worth pointing out that the direction of the coefficients in Models 1 and 2 in Oromiya are also negative. Between-region differences are not necessarily surprising given previous research, which has documented cases in which livestock sales are much less important in the aftermath of shocks

than hypothesized or observed elsewhere (Fafchamps et al. 1998, Kinsey et al. 1998, Lybbert et al. 2004, McPeak et al. 2012). There is no obvious reason to expect that dissimilarities observed between cases from different countries may not also be observed within counties.

Of course, a definitive explanation of the differences observed between Tigray, Amhara, and Oromiya is not possible given the data used in the analysis. However, a number of potential interpretations are worth outlining. For one, previous research suggests that cash from livestock sales is near-uniformly more important than cash from crop sales in Tigray, due in part to low agricultural productivity. In contrast, income from crop sales was found to be more important than from livestock sales in many parts of Amhara and Oromiya (Livelihoods Integration Unit 2010). It is plausible that, on average, households in Tigray may be less likely to store crops or maintain savings from crop sales, and therefore more likely to respond to the effects of rainfall deficits by selling livestock. Households living in the other regions may be more likely to respond to the effects of rainfall deficits in other ways not captured by the outcomes of interest in this analysis. Such variation likely reflects broader, but unobserved structural differences in the economies and agro-ecologies of the regions that mediate the relationship between rainfall deficits, food insecurity, and subsequent household responses. Food insecurity is a multi-dimensional concept, driven not only by environmental shocks (e.g., supply issues) but also the institutional context in which those shocks take place. Such institutional factors affect not only agricultural productivity but also off-farm employment opportunities, food prices, and other conditions shaping access to food that are quite distinct from households' own production. Although the methodological approach used in this analysis leaves these and other potential underlying mechanisms linking rainfall shocks to household responses and within-community

inequality in something of a 'black box', future research should endeavor to investigate the role of these contextual factors (e.g., through cross-regional comparative studies).

Additionally, the typical intra-annual distribution of rainfall—and related planting and harvesting periods—does not vary significantly within Tigray. All parts of the region tend to experience a single rainy season (i.e., unimodal rainfall distribution). This stands in contrast to Amhara and Oromiya, where cropping systems in some areas are based upon a bimodal rainfall distribution (Livelihood Integrations Units 2010). The agricultural impact of a given deficit in annual rainfall may therefore vary more within Amhara and Oromiya than Tigray, since a given deficit may reflect the failure of only one of two rainy seasons in some parts of the former two regions. If there were the case, the resulting heterogeneity within the treatment groups in Amhara and Oromiya would have significant implications for the estimates. It is possible, for example, that the lack of statistical significance for the coefficient estimates for Oromiya (Table 6.8) could be in part driven by such within-treatment group differences. This possibility speaks to a broader methodological issue. Tigray is the smallest (area) and most socially and agro-ecologically homogenous among the three regions in this study. For the purposes of these analyses, low variation within a region is advantageous because it decreases the risk of violating the parallel track assumption described above, and increases the likelihood that the impact of, and responses to a given deficit in annual rainfall do not vary among affected communities. The inverse is true for high variation within region.

In sum, there are both substantive and technical interpretations of the between-region differences in the estimated association between rainfall deficits and livestock inequality. Future research should endeavor to compare community-level effects of environmental shocks between cases with clear, well-identified differences in institutional and agro-ecological context.

Descriptions of change across the wealth distribution

Finally, I examine the extent to which the negative effect of rainfall deficits on within-community livestock inequality observed in Tigray was driven by changes in the upper and lower tails of communities' livestock distribution. For communities in the control group and each of the four treatment groups used in the models above (Tables 6.6-6.8), I calculate the mean 25th and 75th percentiles with respect to household livestock ownership in each year. For each group, I then calculate the change in the mean 25th and 75th percentiles between 2005 and 2011, respectively, and compare changes in the treatment and control groups.

Table 6.9 *Changes in mean 25th and 75th percentiles (TLUs) 2005-2011, by rainfall deficit*

Group	Δ, 25th pct.	Δ, 75th pct.	Difference
	No drought		
z≥0.0	-0.830	-0.859	-0.029
	Drought		
z<0.0	-0.075	-0.304	-0.229
z<(-)0.25	-0.124	-0.349	-0.225
z<(-)0.5	-0.236	-0.447	-0.211
z<(-)0.75	-0.261	-0.466	-0.205

Source: EDHS & NASA-POWER

The results (Table 6.9) demonstrate that levels of livestock wealth at the 25th and 75th percentiles declined in both drought-affected and non-affected areas. In drought-affected areas, however, declines in the upper tail of the distribution—as indicated by the absolute value of the 75th percentile—were much larger relative to declines in the lower tail of the distribution. For example, when using a z = -0.25 threshold to define drought, the absolute decline in the mean 75th percentile of livestock holdings was 0.229 TLUs larger than the decline in the mean 25th percentile in drought-affected areas. In contrast, the decline in the mean 75th percentile was only 0.029 TLUs larger than the decline in the mean 25th percentile in non drought-affected areas. I repeat this exercise using all other control groups (Table 6.9); and perform similar calculations

comparing the 10th and 90th percentiles (results not shown). The results of these analyses suggest that the observed equalizing effect of rainfall deficits was driven largely by decreases in livestock holdings among households in the upper tail of the livestock distribution.

Discussion

This analysis finds that rainfall deficits have a significant equalizing effect on livestock inequality within some Ethiopian communities, but this effect varies by region. In Tigray, there is robust evidence that mean within-community livestock inequality in 2011 would have been significantly higher in the absence of the rainfall shocks that affected parts of the region. Estimated differences in this effect across the three regions are marginally significant, and suggest that livestock inequality in Amhara and Oromiya is less sensitive to rainfall shocks than in Tigray. Region-specific models support this interpretation, showing a non-zero effect in Tigray and non-significant effects elsewhere. Between-region differences may reflect relatively high levels of variation in normal rainfall patterns and related agricultural systems within Amhara and Oromiya. It may also reflect differences in the role of livestock sales in household coping strategies. In nearly all parts of Tigray, livestock sales are a more important source of cash than crop sales, but are relatively less important in many parts of Amhara and Oromiya (Livelihoods Integration Unit 2010).

The estimated effects of rainfall deficits on asset inequality within communities are non-significant. This is not necessarily surprising given that many of the assets used to construct the household asset index are not commonly sold as a part of coping strategies in rural Ethiopia. Since assets like farming and cooking implements are mainly thought of in terms of their practical or use value, there is little demand for such items from other households or local

traders, particularly during periods of stress. This stands in contrast to livestock, which are a major store and source of wealth, prestige, and in some cases food. As a result of these social and economic imperatives to accumulate livestock, there is often persistent demand from within and outside of communities. It is therefore relatively easy to liquidate livestock holdings to obtain money needed to purchase food or other items in the market during periods of stress.

The equalizing effect of rainfall deficits on within-community livestock distributions was expected given the previous literature on coping strategies and hypothesized differences in households' likelihood of engaging in consumption and asset smoothing behaviors. This finding may nonetheless be surprising to some, given the common assumption that the poor are uniformly more affected by shocks than better-off households. Although the poor and marginalized are often generally more disadvantaged during environmental crises than others (Wisner et al. 2004), analytically, it is important to recognize that the observed distribution a given shock's impact is contingent upon the particular outcome being considered. This analysis focuses solely on assets and livestock, which better-off households tend to accumulate more than the poor. In terms of these two indicators, therefore, wealthy households were more exposed to the effects of rainfall deficits than the poor.

Of course, careful consideration of the outcome being examined should also lead one to acknowledge the substantive implications and limitations of a particular result. In this case, changes in a given household's livestock herds likely reflect its ability to maintain food consumption during periods of stress. The relatively large effect of rainfall deficits on better-off households' livestock stores may therefore reflect their ability to maintain relatively high levels of food consumption by drawing upon their wealth. In contrast, the relatively small losses among the asset-poor may correspond with growing food insecurity, since these households lack the

baseline wealth to draw upon during crises. Over time, liquidation of wealth among the livestock-rich may also represent a decline in their ability to assist others in the community by sharing food, lending money, or providing wage labor opportunities to those in need of cash for food. The equalizing impact of rainfall deficits on within-community livestock distributions may therefore reflect significant and growing inequalities in nutrition and other important outcomes, as well as the breakdown of important informal redistributive mechanisms. Such outcomes may constitute a 'dark side' of equality.

Future research

These findings represent a first step toward understanding the relationship between environmental shocks and inequality within rural agrarian communities. This study utilizes existing data in a novel way to provide the most robust empirical evidence about this relationship to date. Future research should continue to find creative ways of exploiting existing data to study this question. However, new data collection efforts will eventually be needed to better understand the effect of environmental shocks on inequality and other community-level outcomes. In particular, advancing knowledge about this issue will require longitudinal data for a large number of communities at relatively frequently intervals. This is an ambitious task, but researchers can conserve resources by continuing to exploit the opportunities for natural experiments that rainfall shocks and other environmental phenomena often present.

With longitudinal data in hand, researchers should build upon this study by using decomposition techniques to quantify how differential outcomes among particular sub-groups within communities contribute to overall shock-related changes in inequality. These techniques should also be used to assess how selective in- and out-migration related to environmental

shocks contributes to inequality dynamics. Such analyses will provide empirical evidence about the underlying group- and micro-level processes that link environmental shocks to changes in inequality.

Further research on the community-level impacts of environmental shocks is both theoretically and practically important. Theoretically, research should continue to consider whether environmental processes are important drivers of stratification between households, which is a perennial topic of interest among social scientists (Firebaugh 1999, Grusky et al. 2008). Researchers should consider the effect of environmental shocks on inequality to be a complementary line of inquiry to the more common focus on the social determinants of environmental inequalities and vulnerability (e.g., Crowder and Downey 2010).

Practically, knowledge about the impact of environmental shocks on inequality within communities is important because individual- and household-level outcomes may be affected by the distribution of resources and the relative wellbeing of other community members. These include short- and longer-term nutritional and economic outcomes of concern to humanitarian and development practitioners. In most cases, responses to shocks involve not only individual or household resources, but also those of other community members. A focus on community social structure—and underlying heterogeneity in vulnerability across households—may help policymakers and practitioners to understand inter-household dynamics in shock-affected communities, identify at-risk groups and communities, and devise new community-based interventions to reduce vulnerability and mitigate the effects of environmental shocks.

CHAPTER 7: CONLCUSION

Summary

This dissertation has examined the relationship between rainfall deficits and social and economic inequality within rural Ethiopian communities. The first set of analyses focused on the case of a single rainfall deficit-affected community in rural southern Ethiopia. There, data showed that wealth inequality decreased at a greater rate during the drought-affected years (2011-2013) than a preceding year with average rainfall (2010-2011). This evidence, in conjunction with data from interviews and focus groups, suggests that, combined, the responses of households in Kejima had an equalizing effect on the distribution of wealth in the community.

Most drought-related changes in wealth involved livestock rather than other types of assets. The link between non-livestock wealth dynamics and rainfall deficits in the case study community appears spurious in light of other evidence. For example, both interview and survey data indicated that sales of these assets were not commonly used in household coping strategies. In contrast, many livestock sales during the 2011-2013 period were motivated by impacts of the rainfall deficits—mainly related food insecurity—and were used to generate cash during the years of environmental stress and related food insecurity. Data from both the household survey and qualitative interviews suggest that livestock losses—sales, and in some cases mortality—were most common among households that were relatively livestock-rich prior to the drought. This is consistent with the finding that rainfall deficits were associated with an equalization of livestock holdings among households in the field site; and suggests that equalization of livestock ownership was driven largely by a downward shift in the upper tail of the pre-shock livestock distribution.

The case study findings are also consistent with results from an analysis of the association between rainfall deficits and wealth inequality within rural communities in three regions of Ethiopia (Chapter 6). This set of analyses demonstrated that rainfall deficits were systematically associated with decreases in within-community livestock inequality, but only among communities in Tigray. A non-significant association between rainfall and livestock inequality was observed in Amhara and Oromiya.

The regional variation in this relationship may reflect a number of possible factors, which were described in-depth in Chapter 6. To summarize, between-region differences may reflect variability in the role of livestock sales in household coping strategies. For example, other research has suggested that cash from crop sales may be more important than from livestock sales in some parts of Amhara and Oromiya. These two regions are more diverse than Tigray in other ways as well, including with respect to climate (e.g., normal rainfall patterns). Such unobserved within-region variation may help explain the non-significant effect observed in Amhara and Oromiya.

In contrast, rainfall deficits were not associated with significant changes in non-livestock asset inequality in any of the three regions of the analysis in Chapter 6. This result is consistent with the findings from the case study, which showed that non-livestock asset transactions did not play a significant role in households' responses to drought. Households purchase many of the assets considered in this part of the analysis for their use value (e.g., for preparing fields or food) rather than as stores of wealth that can be easily exchanged for other goods or services. The role of non-livestock assets stands in contrast to livestock, which in addition to their use value are seen as among the most reliable forms of savings in many parts of Ethiopia (including the case study site). Unsurprisingly, many interview respondents described a motivation to accumulate

multiple livestock, but none described a similar motivation to accumulate other assets (e.g., plows) in the same manner (though some sought improved tools or housing materials).

Perceptions about the different values of livestock and other assets have at least three potential implications for understanding the non-significant relationship between rainfall deficits and non-livestock asset inequality. First, households may have viewed many non-livestock assets as essential—for shelter or agricultural production, for example—and were therefore less likely to sell them in response to a short-term crisis. Second, demand for these assets may have been low relative to livestock—that is, there were few if any potential buyers of non-livestock assets. The social and economic benefits for potential buyers to accumulate livestock as a result of distress sales is likely much higher than accumulating other assets typically bought for only their use value. Third, and more broadly, livestock sales are perceived to be a normal, socially acceptable means of responding to rainfall shocks and other crises. The same does not hold true for non-livestock assets.

Of course, livestock and other assets represent only one dimension of inequality. The case study demonstrated that poor rains also had heterogeneous implications across the affected community with respect to the timing and severity of food insecurity, labor market outcomes, and the formation of social and economic relationships. In many cases, households that sold livestock did so from of a position of relative strength within the community. Many of these households were able to use the proceeds of sales to maintain adequate levels of food consumption, avoid coping strategies with particularly negative implications, and assist other more needy households. Often, such assistance was paid back in cash or labor, or implicitly increased (or maintained) the benefactor's access to the beneficiary's labor when it was needed in the future (e.g., to weed the next year's crops). In contrast, less wealthy households often

responded to drought-related food insecurity by engaging in wage labor, and borrowing or receiving food or money. In many cases, the receipt of resources during periods of environmental stress improved access to essential food, but also came 'with strings attached' in the form of repayment—with interest in some cases—or expectations of future labor.

These relationships—characterized by dependency or obligation—likely had implications for households' long-term wellbeing. Although this analysis was not able to examine the long-term effect of these relationships empirically, households that improved their access to free or low-wage labor (or interest payments) by providing assistance to others appeared relatively well positioned to recover and accumulate wealth in years after the shock. In contrast, those that received assistance during the drought were often forced to assume time-intensive, low-wage labor obligations. The potentially adverse effects of such commitments on post-drought recovery seem clear.

Theoretically, the interpretation of the observed forms of assistance and obligation is somewhat difficult (Platteau 1995). On the one hand, many wealthy households provided other community members with valuable assistance during a period of environmental stress and related food insecurity. The transfers, loans, and opportunities for wage labor during this period undoubtedly mitigated the negative consequences of drought for many households beyond what was observed. As such, obligations to repay benefactors with money or labor in the future may be interpreted as a form of reciprocity, linking relatively wealthy and poor households through mutually beneficial relationships. However, the short-term benefits that assistance and redistribution often had for relatively poor households may come at potentially significant long-term costs to them. In contrast, relationships formed through assistance may have cumulative benefits to benefactor households with respect to their recovery and position in local labor

markets. For example, low-wage or wage-free labor represents a time and energy sink, and potentially lost wages for those who engage in it (i.e., labor). Those who utilize such labor on their land may benefit via reduced labor costs and increased agricultural productivity. From this perspective, environmental shocks create a context in which some households are able to secure long-term advantages over others through relationships that are likely to produce or perpetuate wealth inequality and social divisions within the community.

Contributions

This dissertation represents one of few studies on the relationship between environmental shocks and between-household social and economic inequality, and to my knowledge, the first study to examine how environmental shocks shape inequality within affected communities. The community-level focus arguably advances research on this topic in at least two ways. For one, communities are loci of social and economic interaction. As such, they are sites of many of the processes that produce, reproduce, or change inequality, as well as spaces in which the consequences of inequality manifest. This study was therefore able to identify behaviors that households deploy, and relationships they develop during times of drought to maintain food security in some cases, and to develop new bases of social and economic advantage in others. This stands in contrast to previous research's focus on inequality within broad geographic units, which are remote from the places that most social interactions take place.

Second, the community-level focus of this dissertation facilitates more precise measurement of populations' exposure to rainfall shocks relative to other studies. Rainfall conditions rarely vary significantly within communities, so changes in within-community inequality are unlikely to be attributable to heterogeneous exposure to drought. In contrast,

previous studies on this topic have measured environmental conditions at higher geographic scales, such as regions and zones, within which conditions are likely to vary markedly. In these cases, it is difficult to disentangle within- and between-unit variation in environmental conditions, and thus accurately measure exposure to environmental shocks and their effect on inequality.

This dissertation makes a number of more general contributions. For one, it offers a critical perspective on common assumptions about inequality. Many sociologists arguably assume equality, or moderate inequality is a normatively good thing. However, the results of this study demonstrate that equality, or equalization with respect to one outcome (in this case, livestock holdings) may be associated with growing inequality with respect to another outcome(s) (e.g., food security, labor market outcomes). That is, the same set of processes that contribute to equality in terms of one outcome may contribute to growing inequality in terms of another in the short and/or long run.

Also, the findings complicate theoretical expectations about conflict and inequality by highlighting a tension between (a) the often-critical transfers, loans, and income-generating opportunities that better-off households may provide poorer neighboring households during periods of environmental stress; and (b) the likelihood that obligations and relationships formed through such assistance may deepen or entrench inequality in the community over the long run. Put differently, this study shows that the distinction between assistance and exploitation is sometimes ambiguous—or, perhaps, should be conceptualized as a continuum rather than a binary choice.

The results of this study should serve as a reminder for scholars to think critically about the particular dimension(s) of inequality they are examining, and the potential links between that

particular outcome and others. These findings also underline how the temporal scope of one's analysis may affect one's conclusions. For example, the case study showed that the short-run consequences of rainfall deficits—reduced inequality with respect to livestock holdings; and substantial assistance from relatively wealthy households to the relatively poor—differed markedly from the likely long-term consequences of such shocks—which generally entailed increased stratification and social divisions. Future research must continue to explore the link between short-run effects, or responses, and forms of cumulative advantage or disadvantage.

The results of these analyses should also encourage scholars to reconsider how the relationship between environmental shocks and social and economic inequality is conceptualized. These conceptual issues include assumptions about the direction of causality. Within environmental sociology, research to date has largely framed social and economic processes as determinants of environmental risk, vulnerability, or impacts. That is, when examining an environmental outcome, emphasis has been placed rather squarely on the social determinants. This approach is evident in a range of specific literatures, including those on exposure to environmental/industrial hazards (Crowder and Downey 2010), social vulnerability (Cutter et al. 2003), and natural disasters (Thiede and Brown 2013). The relationship between social inequality and the environment has been framed similarly in geography and development studies (e.g., Adger 1999, Mueller et al. 2014, Watts and Bohle 1993). In contrast, this study suggests that causality may also operate in the other direction: environmental events and conditions may also be a determinant of social and economic change.

While acknowledging the ways in which vulnerability to environmental shocks is indeed socially constructed, this dissertation draws attention to the effects of environmental shocks on post-shock social relations and inequality. From this approach, outcomes during environmental

crises may not simply reflect or reinforce existing social inequalities, but may rather transform them. In other words, environmental shocks mark a discontinuity in secular processes of stratification observed prior to a shock. The argument that environmental events may have causal and persistent social effects is clear in some existing research (e.g., Erikson 1976, Groen and Polivka 2010, Maccini and Yang 2009), but to my knowledge none on inequality. Perhaps more importantly, this argument is usually only implicit in existing research, which may reflect environmental sociologists' unease with claims that hint of environmental determinism.

Of course, I am not advancing a pro-determinist argument. Rather, this dissertation ultimately suggests that it may be productive to move away from a purely "social determinants" perspective on vulnerability to environmental change, and consider how, over time, social inequalities and environmental shocks interact in a cyclical manner. Assuming that vulnerability and responses to environmental shocks are heterogeneous, these events will re-structure social relations and inequality within affected communities over both the short and long run. In turn, these changes in inequality and social relations may also reshape—but again, not necessarily reinforce in a linear manner—the post-shock distribution of vulnerability to future shocks. That is, environmental shocks at one time may have a causal effect on the distribution of vulnerability to future shocks via its effects on social and economic inequality. In many chronically shock-affected parts of the developing world, such processes are likely to have salient implications for poverty reduction and rural development in the future.

Finally, this dissertation also exceeds the standard of existing evidence on this topic. In the analyses presented in Chapter 6, I exploit the exogenous placement of rainfall shocks within regions of Ethiopia to compare pre-post changes in mean within-community inequality in areas exposed to rainfall deficits with changes in areas not affected by deficits. While not without

limitations, this marks an improvement relative to previous studies. Existing work has utilized poorly defined case and control groups (a function of their higher levels of analysis) or estimated within-subjects effects without controls for changes in potentially confounding factors (a function of their small sample sizes). Additionally, this dissertation integrates large-n analyses with evidence from an in-depth, mixed-methods case study. Together, these analyses provide insight into the generalizability of claims about the relationship between rainfall deficits and asset and livestock inequality and, importantly, examine the social and economic processes that explain the link between rainfall deficits and various forms of socioeconomic inequality.

Future research

As the first analysis of the association between rainfall deficits and inequality within communities, and one of few studies of this topic at any unit of analysis, there is considerable room for future research. Methodologically, the limitations of this study represent opportunities for future analyses to improve upon. For one, the large-n analysis in Chapter 6 draws upon two years of repeated cross-sectional data. As a result, the estimated drought effect may partially reflect sampling-related changes in the composition of the communities and households observed in the study. This limitation underlines the need for panel data on a large number of both communities and households within those communities. Such data are currently not available, to my knowledge. Existing large and geographically broad panel studies—such as the Indonesian Family Life Survey (IFLS)—may collect data from a large number of households in a large number of communities, but their focus on individuals ultimately precludes analyses of community-level outcomes over time. By tracking the same households over time and ensuring that each panel collects a representative sample of community members at each time (e.g.,

samples new in-migrants), future research can eliminate the possibility that inter-period changes reflect sampling rather than substance.

Moreover, such panel data will provide researchers with the evidence needed to address a number of important substantive issues not considered in this analysis. These include identifying regional- and community-level factors that may mediate the effect of rainfall shocks on social and economic inequality (e.g., explain different effects among regions or communities), and assessing the extent to which inequality dynamics may be affected by selective in- and out-migration related to a given environmental shock. Panel data would also facilitate estimates of the contribution of particular types of changes (e.g., cattle sales or mortality; borrowing and loans), and wealth or labor dynamics among particular groups, to drought-related changes in inequality. As the number of panels in such data increases, researcher may also want to examine the long-term effects of environment-induced changes in inequality on other outcomes, including resilience or vulnerability to future environmental shocks, political conflict, and social mobility. That is, researchers could empirically examine the potentially cyclical relationship between environmental and community dynamics.

Collecting these data would require an ambitious effort. However, these questions are relevant to practical concerns about climate change, and as such merit the resources needed for data collection. Moreover, these data could also be used to address a broad set of questions not necessarily related to inequality or environmental shocks, and as such would provide a valuable resource for development scholars more broadly. That said, researchers should still consider implementing studies in such a manner that they can exploit the often-random nature of environmental shocks, and thereby utilize natural experiments that are both resource efficient and empirically robust.

The substantive findings of this dissertation also provoke a number of questions for future research. Perhaps foremost, this study has highlighted a tension between functionalist explanations of assistance during crisis and subsequent obligations, and alternative accounts that highlight conflict and exploitation. This is an important theoretical issue that could be explored in greater depth through research designed specifically for this question.

Additional evidence is also needed to explain differences between drought-related livestock and non-livestock asset dynamics. Why are certain forms of property not utilized when coping with crises? Answers to this question will likely require comparative analyses. Indeed, research on the broader question of how environmental shocks affect inequality is needed in contexts outside of sub-Saharan Africa, where this and all known existing research on this topic has been situated. The between-region differences in this study's estimates demonstrate that context matters. Investigating these context-specific differences may produce insight into underlying causal processes.

Broadly, climate change and social inequality are arguably among the world's most pressing contemporary social issues. Understanding the relationship between these two processes is theoretically compelling, but also practically important given the potential implications for rural development in shock-affected areas. In contexts like Kejima and other parts of rural Ethiopia, the implications of vulnerability are non-trivial: they have consequences for households' food security and odds of escaping extreme poverty, or at least enduring the inevitable next shock. This dissertation demonstrated that the effect of environmental shocks is not only a function of a given household's characteristics, but also its relationships with other community members. Vulnerability and resilience are unlikely to be solely determined by autonomous households, but may also be contingent upon resources possessed by other

community members. While the level of a given household's resources matters, so may the distribution of resources and power relationships between households.

Continued and improved research can undoubtedly help inform policies and interventions to improve social and economic outcomes during and after environmental crises. This dissertation demonstrates that analysis of community-level outcomes and relations between households may provide new insights into social and economic dynamics in places affected by environmental crises. Policymakers and practitioners should consider how the effects of such crises are distributed among households, as well as the long-term implications of social relationships formed during periods of stress. For instance, labor obligations—particularly informal ones—may not currently be considered in many development or humanitarian assessments, but may nonetheless constitute a major constraint to some households' recovery from shocks and prospects of escaping poverty. Understanding these and other social and community dynamics may lead to new approaches for attempting to improve outcomes during and after environmental shocks, and therefore address a major underlying driver of poverty and other forms of deprivation across the world.

APPENDIX

Survey Instrument

Environmental Shocks and Social Inequality: Evidence from Ethiopia

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Modules on Resilience and Graduation among Chronically Food Insecure Ethiopian Households

Brian C. Thiede
Department of Development Sociology
Cornell University

In collaboration with CARE-Ethiopia

Survey - 1

The purpose of this research is to study the impact of environmental shocks on household and community social and nutritional outcomes.

Participation in this study will require that you answer a series of questions about your household's experience with drought, social and economic status, and food security over the past four years. It will take approximately one to two hours of your time.

Beyond the time spent answering these questions, there are no known costs or risks of participating in this study. We do not anticipate any risks to your participation other than those encountered in daily life. The research team will protect your confidentiality by securely storing the completed surveys, and then destroying them upon entering them into a computer in a way that conceals your identity. Audio recordings of interviews will also be saved in a way that conceals your identity.

There are no direct benefits to your participation in this study, although over the long run, the knowledge produced from this research may contribute to policies and interventions that help shock-affected households and communities.

Your participation in this study is voluntary. You do not need to participate, and you may discontinue your participation and skip questions at any time, without any negative consequences. You may also ask questions about the study at any time before, during, or after you participate.

Do you have any questions? [Enumerator circle one: YES NO]

Do you consent to participating in this study? [Enumerator circle one: YES NO]

Do you consent to participating in an open-ended interview, and being recorded by an audio recording device? [Enumerator circle one: YES NO]

Enumerator initials and date:_____

Survey - 2

PART 1: BASIC SURVEY INFORMATION

Date:	Location (village, kebele):	Enumerator name:

PART 2: BASIC HOUSEHOLD INFORMATION

A. Household ethnicity and clan affiliations
HH Ethnicity (write-in):
HH Clan (write-in):

B. Demographic roster

ID number	Name	Age	Sex	Rel. to head	Education	Work status	Location
01				*Head of HH*			
02							
03							
04							
05							
06							
07							
08							
09							
10							
11							
12							
13							
14							
15							

Sex: 01=male, 02=female; **Relationship to head:** 01=spouse, 02=child, 03=parent, 04=brother, 05=sister, 06=uncle, 07=aunt, 08=niece, 09=nephew, 10=grandparent, 11=grandchild, 12=other (write-in); **Education:** 01=none, 02=some primary, 03=completed primary, 04=some secondary, 05=completed secondary or more; **Employment:** 01=able to work, 02=disabled, 03=too young to work, 04=too old to work; **Location:** 01=lives in main household dwelling, 02=lives in other dwelling in village, 03=lives in other village, same kebele, 04=lives in other kebele, same woreda, 05=lives in other woreda, same region, 06=lives in other region;

C. Household deaths since 2010

Name	Year of death	Age at death

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D. All infant deaths (age 0-1) ever experienced					
HH ID of Mother	**Age of mother at infant's birth**	**Location of birth**	**Age of infant (months)**	**Sex of infant**	**Cause of death**
Sex: 01=male, 02=female; **Cause of death:** 01=HIV, 02= diarrhea, 03=malaria, 04=respiratory illness, 05= malnourished, 06= other (write in), 07=does not know; **Location:** 01=home (no medical care); 02=home (with medical care); 03=local clinic; 04=region hospital; 05=other (write-in);					

PART 3: GOVERNMENT AND NGO SUPPORT

A. Productive Safety Net Program (PSNP) experience			
Date started	**Type of support**	**Date ended**	**Reason for graduation**
Type of support: 01=public work, 02=direct assistance/transfers, 03=both; **Reason for graduation:** 01=HH choice, 02=correct government decision (HH was food secure), 03=forced government decision (HH was NOT food secure), 04=other (write-in);			

B. Other government and non-governmental organization (NGO) support experience since 2010					
Date started	**Type of support**	**Organization name**	**ETB received per month**	**Food aid received per month (write-in)**	**Date ended**
Type of support: 01=food aid, 02=cash transfers, 03=seed transfer, 04=other asset transfer (e.g., agricultural tools), 05=agricultural training, 06=other training, 07=other (write-in);					

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PART 4: SHOCK HISTORY

A. Normal planting month(s):	**B. Normal harvest month(s):**
C. Normal Belg rain month(s):	**D. Normal Meher rain month(s):**

E. Overview of drought history (BELG 2010-2013)				
BELG	**Rainfall amount** (1=very low, 2=low, 3=normal, 4=high, 5=very high)	**Rainfall timing** (1= very early, 2=early, 3=normal, 4=late, 5=very late)	**Crop output** (1=very low, 2=low, 3=normal, 4=high, 5=very high)	**Changes in cropping practices due to rainfall amount/ timing**
2013				
2012				
2011				
2010				
Responses to rainfall shortage/poor timing: 01=delayed planting, 02=planted earlier than normal, 03=delayed harvest, 04=harvested earlier than normal, 05=planted improved seeds, 06=applied more fertilizer, 07=applied less fertilizer, 08=planted different crops, 09=other (write-in)				

F. Overview of drought history (MEHER 2010-2013)				
MEHER	**Rainfall amount** (1=very low, 2=low, 3=normal, 4=high, 5=very high)	**Rainfall timing** (1= very early, 2=early, 3=normal, 4=late, 5=very late)	**Crop output** (1=very low, 2=low, 3=normal, 4=high, 5=very high)	**Changes in cropping practices due to rainfall amount/ timing**
2013				
2012				
2011				
2010				
Responses to rainfall shortage/poor timing: 01=delayed planting, 02=planted earlier than normal, 03=delayed harvest, 04=harvested earlier than normal, 05=planted improved seeds, 06=applied more fertilizer, 07=applied less fertilizer, 08=planted different crops, 09=other (write-in)				

G. Rainfall, agriculture, and coping experience, 2012-13				
Month/year	**Coping strategies**			
May 2013				
Apr 2013				
Mar 2013				
Feb 2013				
Jan 2013				
2012				
Dec 2012				
Nov 2012				
Oct 2012				
Sep 2012				
Aug 2012				
Jul 2012				
Jun 2012				
May 2012				
Apr 2012				
Mar 2012				
Feb 2012				
Jan 2012				
Responses to rain/crop failure: 01=replanted crops, 02=modified agricultural techniques, 03=sold livestock, 04=sold other productive assets, 05=HH members worked for other HH in the village, 06=HH members worked outside of the village, 07=HH members migrated outside of the village, 08=HH members transferred to other HH, 09=sought/received food or money from government or NGO, 10=sought/received food or money from other households; 11=reduced the number of meals eaten, 12=reduced the size of meals eaten, 13=other (write-in);				

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H. Rainfall, agriculture, and coping experience, 2011				
Month/year	**Coping strategies**			
Dec 2011				
Nov 2011				
Oct 2011				
Sep 2011				
Aug 2011				
Jul 2011				
Jun 2011				
May 2011				
Apr 2011				
Mar 2011				
Feb 2011				
Jan 2011				
2010				
Dec 2010				
Nov 2010				
Oct 2010				
Sep 2010				
Aug 2010				
Jul 2010				
Jun 2010				
May 2010				
Apr 2010				
Mar 2010				
Feb 2010				
Jan 2010				
Responses to rain/crop failure: 01=replanted crops, 02=modified agricultural techniques, 03=sold livestock, 04=sold other productive assets, 05=HH members worked for other HH in the village, 06=HH members worked outside of the village, 07=HH members migrated outside of the village, 08=HH members transferred to other HH, 09=sought/received food or money from government or NGO, 10=sought/received food or money from other households; 11=reduced the number of meals eaten, 12=reduced the size of meals eaten, 13=other (write-in);				

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I. Other shocks, 2010-2013							
Shock	**Year**	**Did you experience? (yes/no)**	**Impact(s)**				**Who was affected?**
Livestock disease	2013						
	2012						
	2011						
	2010						
Crop disease	2013						
	2012						
	2011						
	2010						
Household illness/death	2013						
	2012						
	2011						
	2010						
Theft/loss of assets	2013						
	2012						
	2011						
	2010						
Write in any other shocks experienced between 2010-2013:							
Impacts: 01= <10 livestock deaths, 02=≥10 livestock deaths, 03=<50% crop loss, 04=≥50% crop loss, 05=forced to sell livestock or assets, 06=forced to reduce food consumption, 07-forced to seek other employment, 08=forced to transfer HH members, 09=other (write-in); **Affected:** 01=only your HH; 02=your HH and some other HHs in the village; 03=all HHs in the village;							

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PART 5: PRODUCTIVE/DURABLE ASSET, LIVESTOCK, AND LAND TRANSACTION HISTORY

A. Livestock ownership and transactions, 2010-2013											
Livestock	**# Owned**	**Current price (ETB)**	**Year**	**Transaction type (incl. transfers and slaughter)**	**# (+/-)**	**Reason(s)**	**Price per unit (ETB)**	**Price vs. normal year (1=very low, 2=low, 3=normal, 4=high, 5=very high)**	**Buyer/seller (see code)**	**Location of buyer/seller**	**Status of buyer/seller (1=poor, 2=middle, 3=rich)**
a. Cattle			2013	X	X	X	X	X	X	X	X
	X	X									
	X	X									
	X	X									
	X	X									
	X	X									
	X	X									
	X	X									
		X	2010	X	X	X	X	X	X	X	X
b. Ox			2013	X	X	X	X	X	X	X	X
	X	X									
	X	X									
	X	X									
	X	X									
	X	X									
	X	X									
	X	X									
		X	2010	X	X	X	X	X	X	X	X
c. Goats			2013	X	X	X	X	X	X	X	X
	X	X									
	X	X									
	X	X									
	X	X									
	X	X									
	X	X									
	X	X									
		X	2010	X	X	X	X	X	X	X	X

Transaction type: 01=sale, 02=purchase, 03=transfer in, 04=transfer out, 05=slaughter, 06=other (write-in); **Reason:** 01=savings, 02=for food, 03=for cash to buy food, 04=for cash to buy medicine/treatment, 05=for cash to buy other, 06=debt repayment, 07=gift, 08=social transfer, 09=other (write-in); **Buyer/seller:** 01=family, 02=other farming HH, 03=trader (middleman), 04=merchant, 05=government or NGO, 06=other (write-in); **Location of buyer/seller:** 01=lives in this village, 02=lives in another village in this kebele, 03=lives in a different kebele in this woreda, 04=lives in another woreda in this region, 05=lives in another region

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A. Livestock ownership and transactions, 2010-2013 (continued)											
Livestock	**# Owned**	**Current price (ETB)**	**Year**	**Transaction type (incl. transfers and slaughter)**	**# (+/-)**	**Reason(s)**	**Price per unit (ETB)**	**Price vs. normal year (1=very low, 2=low, 3=normal, 4=high, 5=very high)**	**Buyer/seller (see code)**	**Location of buyer/seller**	**Status of buyer/seller (1=poor, 2=middle, 3=rich)**
d. Sheep			2013	X	X	X	X	X	X	X	X
	X	X									
	X	X									
	X	X									
	X	X									
	X	X									
	X	X									
	X	X									
		X	2010	X	X	X	X	X	X	X	X
e. Donkey			2013	X	X	X	X	X	X	X	X
	X	X									
	X	X									
	X	X									
	X	X									
	X	X									
	X	X									
	X	X									
		X	2010	X	X	X	X	X	X	X	X
f. Horse			2013	X	X	X	X	X	X	X	X
	X	X									
	X	X									
	X	X									
	X	X									
	X	X									
	X	X									
	X	X									
		X	2010	X	X	X	X	X	X	X	X

Transaction type: 01=sale, 02=purchase, 03=transfer in, 04=transfer out, 05=slaughter, 06=other (write-in); **Reason:** 01=savings, 02=for food, 03=for cash to buy food, 04=for cash to buy medicine/treatment, 05=for cash to buy other, 06=debt repayment, 07=gift, 08=social transfer, 09=other (write-in); **Buyer/seller:** 01=family, 02=other farming HH, 03=trader (middleman), 04=merchant, 05=government or NGO, 06=other (write-in); **Location of buyer/seller:** 01=lives in this village, 02=lives in another village in this kebele, 03=lives in a different kebele in this woreda, 04=lives in another woreda in this region, 05=lives in another region

A. Livestock ownership and transactions, 2010-2013 (continued)											
Livestock	**# Owned**	**Current price (ETB)**	**Year**	**Transaction type (incl. transfers)**	**# (+/-)**	**Reason(s)**	**Price per unit (ETB)**	**Price vs. normal year (1=very low, 2=low, 3=normal, 4=high, 5=very high)**	**Buyer/seller (see code)**	**Location of buyer/seller**	**Status of buyer/seller (1=poor, 2=middle, 3=rich)**
g. Chicken			2013	X	X	X	X	X	X	X	X
	X	X									
	X	X									
	X	X									
	X	X									
	X	X									
	X	X									
	X	X									
		X	2010	X	X	X	X	X	X	X	X

Transaction type: 01=sale, 02=purchase, 03=transfer in, 04=transfer out, 05=slaughter, 06=other (write-in); **Reason:** 01=savings, 02=for food, 03=for cash to buy food, 04=for cash to buy medicine/treatment, 05=for cash to buy other, 06=debt repayment, 07=gift, 08=social transfer, 09=other (write-in); **Buyer/seller:** 01=family, 02=other farming HH, 03=trader (middleman), 04=merchant, 05=government or NGO, 06=other (write-in); **Location of buyer/seller:** 01=lives in this village, 02=lives in another village in this kebele, 03=lives in a different kebele in this woreda, 04=lives in another woreda in this region, 05=lives in another region

B. Durable asset ownership and transactions, 2010-2013											
Item	**# Owned**	**Current price (ETB)**	**Year**	**Transaction type (incl. transfers)**	**# (+/-)**	**Reason(s)**	**Price per unit (ETB)**	**Price vs. normal year (1=very low, 2=low, 3=normal, 4=high, 5=very high)**	**Buyer/seller (see code)**	**Location of buyer/seller**	**Status of buyer/seller (1=poor, 2=middle, 3=rich)**
a. Beehive			2013	X	X	X	X	X	X	X	X
	X	X						X			
	X	X									
		X	2010	X	X	X	X	X	X	X	X
b. Axe			2013	X	X	X	X	X	X	X	X
	X	X									
	X	X									
		X	2010	X	X	X	X	X	X	X	X
c. Machete			2013	X	X	X	X	X	X	X	X
	X	X									
	X	X									
		X	2010	X	X	X	X	X	X	X	X
d. Sickle			2013	X	X	X	X	X	X	X	X
	X	X									
	X	X									
e. Spade			2013	X	X	X	X	X	X	X	X
	X	X									
	X	X									
		X	2010	X	X	X	X	X	X	X	X
f. Hoe			2013	X	X	X	X	X	X	X	X
	X	X									
	X	X									
		X	2010	X	X	X	X	X	X	X	X
g. Bucket			2013	X	X	X	X	X	X	X	X
	X	X									
	X	X									
		X	2010	X	X	X	X	X	X	X	X

Transaction type: 01=sale, 02=purchase, 03=transfer in, 04=transfer out, 05=other (write-in); **Reason:** 01=savings, 02=for food, 03=for cash to buy food, 04=for cash to buy medicine/treatment, 05=for cash to buy other, 06=debt repayment, 07=gift, 08=social transfer, 09=other (write-in); **Buyer/seller:** 01=family, 02=other farming HH, 03=trader (middleman), 04=merchant, 05=government or NGO, 06=other (write-in); **Location of buyer/seller:** 01=lives in this village, 02=lives in another village in this kebele, 03=lives in a different kebele in this woreda, 04=lives in another woreda in this region, 05=lives in another region

B. Durable asset ownership and transactions, 2010-2013 (continued)											
Item	**# Owned**	**Current price (ETB)**	**Year**	**Transaction type (incl. transfers)**	**# (+/-)**	**Reason(s)**	**Price per unit (ETB)**	**Price vs. normal year (1=very low, 2=low, 3=normal, 4=high, 5=very high)**	**Buyer/seller (see code)**	**Location of buyer/seller**	**Status of buyer/seller (1=poor, 2=middle, 3=rich)**
h. Plow yoke			2013	X	X	X	X	X	X	X	X
	X	X									
	X	X									
		X	2010	X	X	X	X	X	X	X	X
i. Plow beam			2013	X	X	X	X	X	X	X	X
	X	X									
	X	X									
		X	2010	X	X	X	X	X	X	X	X
j. Grainmill			2013	X	X	X	X	X	X	X	X
	X	X									
	X	X									
		X	2010	X	X	X	X	X	X	X	X
k. Blanket or gabi			2013	X	X	X	X	X	X	X	X
	X	X									
	X	X									
		X	2010	X	X	X	X	X	X	X	X
l. Chair			2013	X	X	X	X	X	X	X	X
	X	X									
	X	X									
		X	2010	X	X	X	X	X	X	X	X
m. Table			2013	X	X	X	X	X	X	X	X
	X	X									
	X	X									
		X	2010	X	X	X	X	X	X	X	X

Transaction type: 01=sale, 02=purchase, 03=transfer in, 04=transfer out, 05=other (write-in); **Reason:** 01=savings, 02=for food, 03=for cash to buy food, 04=for cash to buy medicine/treatment, 05=for cash to buy other, 06=debt repayment, 07=gift, 08=social transfer, 09=other (write-in); **Buyer/seller:** 01=family, 02=other farming HH, 03=trader (middleman), 04=merchant, 05=government or NGO, 06=other (write-in); **Location of buyer/seller:** 01=lives in this village, 02=lives in another village in this kebele, 03=lives in a different kebele in this woreda, 04=lives in another woreda in this region, 05=lives in another region

B. Durable asset ownership and transactions, 2010-2013 (continued)

Item	# Owned	Current price (ETB)	Year	Transaction type (incl. transfers)	# (+/-)	Reason(s)	Price per unit (ETB)	Price vs. normal year (1=very low, 2=low, 3=normal, 4=high, 5=very high)	Buyer/seller (see code)	Location of buyer/seller	Status of buyer/seller (1=poor, 2=middle, 3=rich)
n. Cupboard			2013	X	X	X	X	X	X	X	X
	X	X									
	X	X									
		X	2010	X	X	X	X	X	X	X	X
o. Mat			2013	X	X	X	X	X	X	X	X
	X	X									
	X	X									
		X	2010	X	X	X	X	X	X	X	X
p. Lantern or torch			2013	X	X	X	X	X	X	X	X
	X	X									
	X	X									
		X	2010	X	X	X	X	X	X	X	X
q. Watch or clock			2013	X	X	X	X	X	X	X	X
	X	X									
	X	X									
		X	2010	X	X	X	X	X	X	X	X
r. Radio or cassette player			2013	X	X	X	X	X	X	X	X
	X	X									
	X	X									
		X	2010	X	X	X	X	X	X	X	X

Transaction type: 01=sale, 02=purchase, 03=transfer in, 04=transfer out, 05=other (write-in); **Reason:** 01=savings, 02=for food, 03=for cash to buy food, 04=for cash to buy medicine/treatment, 05=for cash to buy other, 06=debt repayment, 07=gift, 08=social transfer, 09=other (write-in); **Buyer/seller:** 01=family, 02=other farming HH, 03=trader (middleman), 04=merchant, 05=government or NGO, 06=other (write-in); **Location of buyer/seller:** 01=lives in this village, 02=lives in another village in this kebele, 03=lives in a different kebele in this woreda, 04=lives in another woreda in this region, 05=lives in another region

B. Durable asset ownership and transactions, 2010-2013 (continued)											
Item	**# Owned**	**Current price (ETB)**	**Year**	**Transaction type (incl. transfers)**	**# (+/-)**	**Reason(s)**	**Price per unit (ETB)**	**Price vs. normal year (1=very low, 2=low, 3=normal, 4=high, 5=very high)**	**Buyer/seller (see code)**	**Location of buyer/seller**	**Status of buyer/seller (1=poor, 2=middle, 3=rich)**
s. Mobile phone			2013	X	X	X	X	X	X	X	X
	X	X									
	X	X									
		X	2010	X	X	X	X	X	X	X	X
t. Bicycle			2013	X	X	X	X	X	X	X	X
	X	X									
	X	X									
		X	2010	X	X	X	X	X	X	X	X
u. Motorbike			2013	X	X	X	X	X	X	X	X
	X	X									
	X	X									
		X	2010	X	X	X	X	X	X	X	X

Transaction type: 01=sale, 02=purchase, 03=transfer in, 04=transfer out, 05=other (write-in); **Reason:** 01=savings, 02=for food, 03=for cash to buy food, 04=for cash to buy medicine/treatment, 05=for cash to buy other, 06=debt repayment, 07=gift, 08=social transfer, 09=other (write-in); **Buyer/seller:** 01=family, 02=other farming HH, 03=trader (middleman), 04=merchant, 05=government or NGO, 06=other (write-in); **Location of buyer/seller:** 01=lives in this village, 02=lives in another village in this kebele, 03=lives in a different kebele in this woreda, 04=lives in another woreda in this region, 05=lives in another region

C. Housing material, house #1	
Location of home:	
Item	
Floor material	
Wall material	
Roof material	
Floor material: 01=dirt, 02=wood, 03=stone/brick/concrete/cement, 04=other (write-in); **Wall material:** 01=mud/dung, 02=wood, 03=stone/brick/concrete/cement, 04=corrugated iron, 05=thatch, 06=bamboo, 07=other; **Roof material:** 01=mud/dung, 02=wood, 03=stone/brick/concrete/cement, 04=corrugated iron, 05=thatch, 06=bamboo, 07=other	

D. Housing material, house #2 (if applicable)	
Location of home:	
Item	**Current (2013)**
Floor material	
Wall material	
Roof material	
Floor material: 01=dirt, 02=wood, 03=stone/brick/concrete/cement, 04=other (write-in); **Wall material:** 01=mud/dung, 02=wood, 03=stone/brick/concrete/cement, 04=corrugated iron, 05=thatch, 06=bamboo, 07=other; **Roof material:** 01=mud/dung, 02=wood, 03=stone/brick/concrete/cement, 04=corrugated iron, 05=thatch, 06=bamboo, 07=other	

E. Land ownership, 2010-2013		
Year	**Location(s)**	**Owned (ha)**
2013 (current)		
2012		
2011		
2010		
Location: 01=this village, 02=another village in this kebele, 03=another kebele in this woreda, 04=another woreda in this region, 05=another region;		

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F. Land rental transactions, 2010-2013											
Year	**Location of land**	**Rented in (ha)**	**Rent paid per year (ETB)**	**Price vs. normal year (1=very low, 2=low, 3=normal, 4=high, 5=very high)**	**Rented out (ha)**	**Rent paid (ETB)**	**Price vs. normal year (1=very low, 2=low, 3=normal, 4=high, 5=very high)**	**Reason(s)**	**Renter/rentee (see code)**	**Location of renter/rentee**	**Status of renter/rentee (1=poor, 2=middle, 3=rich)**
2013											
2012											
2011											
2010											

Location: 01=this village, 02=another village in this kebele, 03=another kebele in this woreda, 04=another woreda in this region, 05=another region;); **Reason:** 01=to expand crop production, 02=to decrease crop production, 03=because HH migrated, 04=for cash to buy food, 05=for cash to buy medicine/treatment, 06=for cash to buy other, 07=debt repayment, 08=gift, 09=social transfer, 10=other (write-in); **Renter/rentee:** 01=family, 02=other farming HH, 03=trader (middleman), 04=merchant, 05=government or NGO, 06=other (write-in); **Location of renter/rentee:** 01=in this village, 02=in another village in this kebele, 03=in a different kebele in this woreda, 04=in another woreda in this region, 05=in another region

G. Land transfers, 2010-2013							
Year	**Location of land**	**Transferred in (ha)**	**Transferred out (ha)**	**Reason(s)**	**Source/recipient (see code)**	**Location of source/recipient**	**Status of source/recipient (1=poor, 2=middle, 3=rich)**
2013							
2012							
2011							
2010							

Location: 01=this village, 02=another village in this kebele, 03=another kebele in this woreda, 04=another woreda in this region, 05=another region; **Reason:** 01=to expand crop production, 02=to decrease crop production, 03=to store savings, 04=because HH migrated, 05=for cash to buy food, 06=for cash to buy medicine/treatment, 07=for cash to buy other, 08=debt repayment, 09=gift, 10=social transfer, 11=other (write-in); **Source/recipient:** 01=family, 02=other farming HH, 03=trader (middleman), 04=merchant, 05=government or NGO, 06=other (write-in); **Location of source/recipient:** 01=in this village, 02=in another village in this kebele, 03=in a different kebele in this woreda, 04=in another woreda in this region, 05=in another region

PART 6: LAND QUALITY AND USE HISTORY

A. What is the quality of your soil (1=very bad, 2=bad, 3=medium, 4=good, 5=very good))?	
B. How does the quality of your soil now compare to the quality of your soil in 2010? (1=much worse than 2010, 2=worse than 2010, 3=same as 2010, 4=better than 2010, 5=much better than 2010)	

C. Overall use of accessible land				
Year of growing season:	**2013**	**2012**	**2011**	**2010**
Proportion of all land that your household had access to (including rental) under crop production during BELG (1-10 counters):				
Proportion of all land that your household had access to (including rental) under crop production during MEHER (1-10 counters):				

D. Crop production, 2013				
Crop	**Area planted (ha)**	**Fertilizer use (yes/no)**	**Improved seed use (yes/no)**	**Total output (quintiles)**
Crop: 01=maize, 02=haricot bean, 03=teff, 04=enset, 05=wheat, 06=barley, 07=lentils, 08=oilseeds, 09=potato, 10=sweet potato, 11=sugar cane, 12=tomato, 13=large pepper, 14=chili pepper, 15=berries, 16=other vegetable (write-in), 17=other fruit (write-in), 18=flowers, 19=other (write-in);				

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E. Crop production, 2012				
Crop	**Area planted (ha)**	**Fertilizer use (yes/no)**	**Improved seed use (yes/no)**	**Total output (quintiles)**
Crop: 01=maize, 02=haricot bean, 03=teff, 04=enset, 05=wheat, 06=barley, 07=lentils, 08=oilseeds, 09=potato, 10=sweet potato, 11=sugar cane, 12=tomato, 13=large pepper, 14=chili pepper, 15=berries, 16=other vegetable (write-in), 17=other fruit (write-in), 18=flowers, 19=other (write-in);				

F. Crop production, 2011				
Crop	**Area planted (ha)**	**Fertilizer use (yes/no)**	**Improved seed use (yes/no)**	**Total output (quintiles)**
Crop: 01=maize, 02=haricot bean, 03=teff, 04=enset, 05=wheat, 06=barley, 07=lentils, 08=oilseeds, 09=potato, 10=sweet potato, 11=sugar cane, 12=tomato, 13=large pepper, 14=chili pepper, 15=berries, 16=other vegetable (write-in), 17=other fruit (write-in), 18=flowers, 19=other (write-in);				

G. Crop production, 2010				
Crop	**Area planted (ha)**	**Fertilizer use (yes/no)**	**Improved seed use (yes/no)**	**Total output (quintiles)**
Crop: 01=maize, 02=haricot bean, 03=teff, 04=enset, 05=wheat, 06=barley, 07=lentils, 08=oilseeds, 09=potato, 10=sweet potato, 11=sugar cane, 12=tomato, 13=large pepper, 14=chili pepper, 15=berries, 16=other vegetable (write-in), 17=other fruit (write-in), 18=flowers, 19=other (write-in);				

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H. Irrigation access			
a. Irrigation access? (Yes/No)		b. Who can access irrigation?	
c. Year Built:		d. Builder:	
Access: 01=this HH only, 02=this and some other HHs, 03=all HHs in this village; **Builder:** 01=this HH, 02=another HH or HHs in this village, 03=HH or private individual from outside of this village, 04=government, 05=NGO, 6=other (write-in)			

PART 7: AGRICULTURE AND CLIMATE-RELATED INFORMATION

A. How often do you communicate with extension agents (per month)?			
B. Do you ever receive information about the weather or climate from extension agents?			
C. How often (per month)?			
D. Do you receive information about the weather or climate from any other source(s)?			
	Source #1	**Source #2**	**Source #3**
E. What source(s)?			
F. How often (per month)?			
G. How do you communicate?			
Source: 01=another individual or HH, 02=government official(s), 03=NGO official(s), 04=media (e.g. ratio or television program), 05=other (write-in); **Mode of communication:** 01=in-person, 02=mobile phone, 03=radio or television, 04=other (write-in);			

PART 8: LABOR HISTORY OF ALL HH MEMBERS THAT HAVE WORKED AT LEAST ONE MONTH BETWEEN 2010-2013

A. Labor and income-generating history, 2010-2013, *HHID#:*								
Year	**Work type**	**Location**	**Was this person transferred to another HH? (yes/no)**	**Status of work (1=very low, 2=low, 3=medium, 4=high, 5=very high)**	**Autonomy (1-10, 1=dependence, 10=autonomous)**	**Wage per day (ETB)**	**In kind per day (write-in)**	**If left farm, did person send money back to HH? (yes/no)**
2013								
2012								
2011								
2010								
Work type: 01=farm labor, 02=livestock herding/care, 03=seed sales, 04=crop sales, 05=petty goods sales, 06=trading, 07=construction, 08=manufacturing, 09=teacher, 10=government work, 11=NGO work, 12=health/medicine, 13=other (write-in); **Location:** 01=this farm; 02=another farm in this village, 03=another village in this kebele, 04=another kebele in this woreda, 05=another woreda in this region, 06=another region;								

B. Labor and income-generating history, 2010-2013, *HHID#:*								
Year	**Work type**	**Location**	**Was this person transferred to another HH? (yes/no)**	**Status of work (1=very low, 2=low, 3=medium, 4=high, 5=very high)**	**Autonomy (1-10, 1=dependence, 10=autonomous)**	**Wage per day (ETB)**	**In kind per day (write-in)**	**If left farm, did person send money back to HH? (yes/no)**
2013								
2012								
2011								
2010								
Work type: 01=farm labor, 02=livestock herding/care, 03=seed sales, 04=crop sales, 05=petty goods sales, 06=trading, 07=construction, 08=manufacturing, 09=teacher, 10=government work, 11=NGO work, 12=health/medicine, 13=other (write-in); **Location:** 01=this farm; 02=another farm in this village, 03=another village in this kebele, 04=another kebele in this woreda, 05=another woreda in this region, 06=another region;								

C. Labor and income-generating history, 2010-2013, *HHID#:*								
Year	**Work type**	**Location**	**Was this person transferred to another HH? (yes/no)**	**Status of work (1=very low, 2=low, 3=medium, 4=high, 5=very high)**	**Autonomy (1-10, 1=dependence, 10=autonomous)**	**Wage per day (ETB)**	**In kind per day (write-in)**	**If left farm, did person send money back to HH? (yes/no)**
2013								
2012								
2011								
2010								
Work type: 01=farm labor, 02=livestock herding/care, 03=seed sales, 04=crop sales, 05=petty goods sales, 06=trading, 07=construction, 08=manufacturing, 09=teacher, 10=government work, 11=NGO work, 12=health/medicine, 13=other (write-in); **Location:** 01=this farm; 02=another farm in this village, 03=another village in this kebele, 04=another kebele in this woreda, 05=another woreda in this region, 06=another region;								

D. Labor and income-generating history, 2010-2013, *HHID#:*								
Year	**Work type**	**Location**	**Was this person transferred to another HH? (yes/no)**	**Status of work (1=very low, 2=low, 3=medium, 4=high, 5=very high)**	**Autonomy (1-10, 1=dependence, 10=autonomous)**	**Wage per day (ETB)**	**In kind per day (write-in)**	**If left farm, did person send money back to HH? (yes/no)**
2013								
2012								
2011								
2010								
Work type: 01=farm labor, 02=livestock herding/care, 03=seed sales, 04=crop sales, 05=petty goods sales, 06=trading, 07=construction, 08=manufacturing, 09=teacher, 10=government work, 11=NGO work, 12=health/medicine, 13=other (write-in); **Location:** 01=this farm; 02=another farm in this village, 03=another village in this kebele, 04=another kebele in this woreda, 05=another woreda in this region, 06=another region;								

E. Labor and income-generating history, 2010-2013, *HHID#:*								
Year	**Work type**	**Location**	**Was this person transferred to another HH? (yes/no)**	**Status of work (1=very low, 2=low, 3=medium, 4=high, 5=very high)**	**Autonomy (1-10, 1=dependence, 10=autonomous)**	**Wage per day (ETB)**	**In kind per day (write-in)**	**If left farm, did person send money back to HH? (yes/no)**
2013								
2012								
2011								
2010								
Work type: 01=farm labor, 02=livestock herding/care, 03=seed sales, 04=crop sales, 05=petty goods sales, 06=trading, 07=construction, 08=manufacturing, 09=teacher, 10=government work, 11=NGO work, 12=health/medicine, 13=other (write-in); **Location:** 01=this farm; 02=another farm in this village, 03=another village in this kebele, 04=another kebele in this woreda, 05=another woreda in this region, 06=another region;								

F. Labor and income-generating history, 2010-2013, *HHID#:*								
Year	**Work type**	**Location**	**Was this person transferred to another HH? (yes/no)**	**Status of work (1=very low, 2=low, 3=medium, 4=high, 5=very high)**	**Autonomy (1-10, 1=dependence, 10=autonomous)**	**Wage per day (ETB)**	**In kind per day (write-in)**	**If left farm, did person send money back to HH? (yes/no)**
2013								
2012								
2011								
2010								
Work type: 01=farm labor, 02=livestock herding/care, 03=seed sales, 04=crop sales, 05=petty goods sales, 06=trading, 07=construction, 08=manufacturing, 09=teacher, 10=government work, 11=NGO work, 12=health/medicine, 13=other (write-in); **Location:** 01=this farm; 02=another farm in this village, 03=another village in this kebele, 04=another kebele in this woreda, 05=another woreda in this region, 06=another region;								

G. Labor and income-generating history, 2010-2013, *HHID#:*								
Year	**Work type**	**Location**	**Was this person transferred to another HH? (yes/no)**	**Status of work (1=very low, 2=low, 3=medium, 4=high, 5=very high)**	**Autonomy (1-10, 1=dependence, 10=autonomous)**	**Wage per day (ETB)**	**In kind per day (write-in)**	**If left farm, did person send money back to HH? (yes/no)**
2013								
2012								
2011								
2010								
Work type: 01=farm labor, 02=livestock herding/care, 03=seed sales, 04=crop sales, 05=petty goods sales, 06=trading, 07=construction, 08=manufacturing, 09=teacher, 10=government work, 11=NGO work, 12=health/medicine, 13=other (write-in); **Location:** 01=this farm; 02=another farm in this village, 03=another village in this kebele, 04=another kebele in this woreda, 05=another woreda in this region, 06=another region;								

H. Labor and income-generating history, 2010-2013, *HHID#:*								
Year	**Work type**	**Location**	**Was this person transferred to another HH? (yes/no)**	**Status of work (1=very low, 2=low, 3=medium, 4=high, 5=very high)**	**Autonomy (1-10, 1=dependence, 10=autonomous)**	**Wage per day (ETB)**	**In kind per day (write-in)**	**If left farm, did person send money back to HH? (yes/no)**
2013								
2012								
2011								
2010								
Work type: 01=farm labor, 02=livestock herding/care, 03=seed sales, 04=crop sales, 05=petty goods sales, 06=trading, 07=construction, 08=manufacturing, 09=teacher, 10=government work, 11=NGO work, 12=health/medicine, 13=other (write-in); **Location:** 01=this farm; 02=another farm in this village, 03=another village in this kebele, 04=another kebele in this woreda, 05=another woreda in this region, 06=another region;								

I. HH members' political, religious, or other leadership positions, 2010-2013				
HH ID	**Position**	**Month/year started**	**Month/year ended**	**Status of position (1=very low, 2=low, 3=middle, 4=high, 5=very high)**
Position: 01=government official, 02=religious official, 03=dispute settlement, 04=NGO official, 05=informal group leader, 06=school leader, 07=other (write-in);				

J. HH hiring and use of non-HH labor, 2010-2013									
Work type	**Start month & year**	**End month & year**	**Worker's relationship to HH**	**Worker sex**	**Worker age**	**Worker status (1=poor, 2=middle, 3=rich)**	**Did the worker become a dependent of the household? (yes/no)**	**Wage paid day (ETB)**	**In-kind paid per day**
Work type: 01=farm labor, 02=livestock herding/care, 03=seed sales, 04=crop sales, 05=petty goods sales, 06=trading, 07=construction, 08=manufacturing, 09=other (write-in); **Worker's relationship to HH:** 01=family/kin, 02=other HH in village, 03=HH outside of village, 04=other (write-in); **Worker sex:** 01=male, 02=female;									

PART 9: MONETARY BORROWING, LENDING, AND TRANSFERS

A. Household monetary borrowing, 2010-2013								
Month/year received	**Original loan (ETB)**	**Remaining loan (ETB)**	**Month/year paid (if loan fully paid)**	**Used PSNP to pay loan (yes/no)**	**Interest rate**	**Lender description**	**Lender location**	**Status of lender (1=poor, 2=middle, 3=rich)**
Lender description: 01=non-HH family/kin, 02=other farmer, 03=private moneylender, 04=bank, 05=government program, 06=NGO program, 07=other (write-in); **Lender location:** 01=this village, 02=another village in this kebele, 03=another kebele in this woreda, 04=another woreda in this region, 05=another region;								

B. Household monetary lending, 2010-2013								
Month/year loan issued	**Original loan (ETB)**	**Outstanding loan (ETB)**	**Month/year paid (if loan fully paid)**	**Used PSNP to pay loan (yes/no)**	**Interest rate**	**Borrower description**	**Borrower location**	**Status of borrower (1=poor, 2=middle, 3=rich)**
Borrower description: 01=non-HH family/kin, 02=other farmer, 03= other (write-in); **Borrower location:** 01=this village, 02=another village in this kebele, 03=another kebele in this woreda, 04=another woreda in this region, 05=another region;								

C. Monetary transfers in, 2010-2013				
Source description	**Source location**	**Month/year received**	**Amount (ETB)**	**Status of source (1=poor, 2=middle, 3=rich)**
Source description: 01= non-HH family/kin, 02=other farmer, 03=private moneylender, 04=bank, 05=government program, 06=NGO program, 07=other (write-in); **Source location:** 01=this village, 02=another village in this kebele, 03=another kebele in this woreda, 04=another woreda in this region, 05=another region;				

D. Monetary transfers out, 2010-2013				
Recipient description	**Recipient location**	**Month/year given**	**Amount (ETB)**	**Status of recipient (1=poor, 2=middle, 3=rich)**
Recipient description: 01=non-HH family/kin, 02=other farmer, 03=private moneylender, 04=bank, 05=government program, 06=NGO program, 07=other (write-in); **Recipient location:** 01=this village, 02=another village in this kebele, 03=another kebele in this woreda, 04=another woreda in this region, 05=another region;				

PART 10: FOOD TRANSFERS AND FOOD SECURITY

A. Current food security				
1. **Has some HH member(s) gone to sleep hungry in the past 30 days because there was not enough food?**	No	1-3 times	4-7 times	8+ times
2. **Has some HH member(s) reduced the size of meals in the past 30 days because there was not enough food?**	No	1-3 times	4-7 times	8+ times
3. **Has some HH member(s) skipped a meal because there was not enough food in the past 30 days?**	No	1-3 times	4-7 times	8+ times

A. Food transfers in, 2010-2013					
Year	**Source description**	**Source location**	**Status of source (1=poor, 2=middle, 3=rich)**	**Number of months received transfer**	**On credit? (yes/no)**
2013					
2012					
2011					
2010					
Source description: 01=non-HH family/kin, 02=other farmer, 03=private lender, 04=government program, 05=NGO program, 06=other (write-in); **Source location:** 01=this village, 02=another village in this kebele, 03=another kebele in this woreda, 04=another woreda in this region, 05=another region;					

B. Food transfers out, 2010-2013					
Year	**Recipient description**	**Recipient location**	**Status of recipient (1=poor, 2=middle, 3=rich)**	**Number of months received transfers**	**On credit? (yes/no)**
2013					
2012					
2011					
2010					
Recipient description: 01=non-HH family/kin, 02=other farmer, 03=other (write-in); **Recipient location:** 01=this village, 02=another village in this kebele, 03=another kebele in this woreda, 04=another woreda in this region, 05=another region;					

C. Food security history, 2012-13			
Month/year	**Hungry period (X=Yes, 0=No)**	**Number of meals per day**	**Size of meals (1-10, 1=smallest)**
May 2013 (Current)			
April 2013			
March 2013			
February 2013			
January 2013			
2012			
December 2012			
November 2012			
October 2012			
September 2012			
August 2012			
July 2012			
June 2012			
May 2012			
April 2012			
March 2012			
February 2012			
January 2012			

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D. Food security history, 2011			
Month/year	**Hungry period (X=Yes, 0=No)**	**Number of meals per day**	**Size of meals (1-10, 1=smallest)**
December 2011			
November 2011			
October 2011			
September 2011			
August 2011			
July 2011			
June 2011			
May 2011			
April 2011			
March 2011			
February 2011			
January 2011			

E. Food security history, 2010			
Month/year	**Hungry period (X=Yes, 0=No)**	**Number of meals per day**	**Size of meals (1-10, 1=smallest)**
December 2010			
November 2010			
October 2010			
September 2010			
August 2010			
July 2010			
June 2010			
May 2010			
April 2010			
March 2010			
February 2010			
January 2010			

PART 11: SOCIAL HISTORY

A. Social status history, 2010-2013				
Year	**Relative rank of household** (1=very low, 2=low, 3=middle, 4=high, 5=very high)	**Autonomy** (1-10, 1=dependent, 10=autonomous)	**Did the HH make any changes in social customs or behaviors because of a lack of money or food? (yes/no)**	**List changes**
2013				
2012				
2011				
2010				
Changes: 01=delayed marriage of HH member, 02=delayed land transfer to HH member (i.e., new household formation), 03=gave smaller or fewer gifts or social transfers than normal, 04=did not give any gifts or social transfers, 05=spent less money on religious or cultural ceremonies, 06=other (write-in).				

B. School enrollment history, 2013					
HHID of all individuals with age <20	**Ever enrolled in school during 2013 (yes/no)?**	**Reason not enrolled**	**Number of months in school**	**Number of months withdrawn/kept from school**	**Reason for withdrawal**
Reason: 01=works on HH farm, 02=works on other farm, 03=cares for HH livestock, 04=cares for other livestock, 05=other work, 06=not enough money for fees/uniforms, 07=child is hungry/not enough money for food, 08=school is too far from HH, 09=academic failure, 10=other (write-in)					

C. School enrollment history, 2012					
HHID of all individuals with age <20	**Ever enrolled in school during 2012 (yes/no)?**	**Reason not enrolled**	**Number of months in school**	**Number of months withdrawn/kept from school**	**Reason for withdrawal**
Reason: 01=works on HH farm, 02=works on other farm, 03=cares for HH livestock, 04=cares for other livestock, 05=other work, 06=not enough money for fees/uniforms, 07=child is hungry/not enough money for food, 08=school is too far from HH, 09=academic failure, 10=other (write-in)					

D. School enrollment history, 2011					
HHID of all individuals with age <20	**Ever enrolled in school during 2011 (yes/no)?**	**Reason not enrolled**	**Number of months in school**	**Number of months withdrawn/kept from school**	**Reason for withdrawal**
Reason: 01=works on HH farm, 02=works on other farm, 03=cares for HH livestock, 04=cares for other livestock, 05=other work, 06=not enough money for fees/uniforms, 07=child is hungry/not enough money for food, 08=school is too far from HH, 09=academic failure, 10=other (write-in)					

E. School enrollment history, 2010					
HHID of all individuals with age <20	**Ever enrolled in school during 2010 (yes/no)?**	**Reason not enrolled**	**Number of months in school**	**Number of months withdrawn/kept from school**	**Reason for withdrawal**
Reason: 01=works on HH farm, 02=works on other farm, 03=cares for HH livestock, 04=cares for other livestock, 05=other work, 06=not enough money for fees/uniforms, 07=child is hungry/not enough money for food, 08=school is too far from HH, 09=academic failure, 10=other (write-in)					

PART 12: PERCEPTIONS OF COMMUNITY OUTCOMES

A. Intra-community inequality				
Outcome	**2013**	**2012**	**2011**	**2010**
Proportion in wealth group (distribute 10 counters)				
Rich				
Middle				
Poor				
Gap between rich and poor (1-10, 1=narrow, 10=large)				

B. Conflict				
Outcome	**2013**	**2012**	**2011**	**2010**
Disputes between HHs (1-10, 1=fewest)				
Thefts (1-10, 1=fewest)				

C. Collective action				
Outcome	**2013**	**2012**	**2011**	**2010**
If a flood destroyed a road near the village, what proportion of HHs would be willing to help solve it? (1-10 counters)				

PART 13: GRADUATION ASPIRATIONS

A. Perceptions of future economic prospects (answered by male HH head; SKIP if female-headed HH)			
1. In 5 years, will you be as wealthy as households that have graduated from PSNP (circle one)? 01=yes, very likely 02=yes, likely 03=don't know 04=no, unlikely 05=no, very unlikely			
2. What are the main barriers to achieving the success of PSNP graduates?			
3. Do you think your children will like more successful/prosperous lives than you (circle one)? 01=yes, very likely 02=yes, likely 03=don't know 04=no, unlikely 05=no, very unlikely			
4. What are the main barriers to your children's success/prosperity?			
5. In how many years do you think you will be able to graduate from PSNP?			
6. What are the main barriers to graduating from PSNP?			
Barriers: 01=not enough opportunities in the area, 02=PSNP does not provide enough support to make changes/investments, 03=debt, 04=continued shocks, 05=investments/changes will not make a difference, 06=lack of education, 07=lack of knowledge, 08=lack of technology, 09=lack of labor, 10=lack of other resources, 11=other (write-in)			

B. Perceptions of self-efficacy (answered by male HH head; SKIP if female-headed HH) *For all answers: 1=very little, 2=little, 3=some, 4=much, 5=very much*	
1. How much do your households' decisions about money, agriculture, and food consumption have an effect on your wealth status?	**1.**
2. How much control does your HH have over the quality of its crop production?	**2.**
3. How much of an effect does PSNP support have on the quality of your HH's crop production?	**3.**
4. How much of an effect does the weather have on the quality of your HH's crop production?	**4.**
5. How much control does your HH have over the amount of food available to eat?	**5.**
6. How much of an effect does PSNP support have on the amount of food available to eat?	**6.**
7. How much of an effect does the weather have on the amount of food available to eat?	**7.**
8. How much control does your HH have over the amount of money/wealth it has?	**8.**
9. How much of an effect does PSNP support have on the amount of money/wealth your HH has?	**9.**
10. How much of an effect does the weather have on the amount of money/wealth your HH has?	**10.**

C. Perceptions of future economic prospects (answered by female spouse of HH head or female head of household)			
1. In 5 years, will you be as successful as households that have graduated from PSNP (circle one)? 01=yes, very likely 02=yes, likely 03=don't know 04=no, unlikely 05=no, very unlikely			
2. What are the main barriers to achieving the success of PSNP graduates?			
3. Do you think your children will like more successful/prosperous lives than you (circle one)? 01=yes, very likely 02=yes, likely 03=don't know 04=no, unlikely 05=no, very unlikely			
4. What are the main barriers to your children's success/prosperity?			
5. In how many years do you think you will be able to graduate from PSNP?			
6. What are the main barriers to graduating from PSNP?			
Barriers: 01=not enough opportunities in the area, 02=PSNP does not provide enough support to make changes/investments, 03=debt, 04=continued shocks, 05=investments/changes will not make a difference, 06=lack of education, 07=lack of knowledge, 08=lack of technology, 09=lack of labor, 10=lack of other resources, 11=other (write-in)			

B. Perceptions of self-efficacy (answered by female spouse of HH head or female head of household) *For all answers: 1=very little, 2=little, 3=some, 4=much, 5=very much*	
1. How much do your households' decisions about money, agriculture, and food consumption have an effect on your wealth status?	**1.**
2. How much control does your HH have over the quality of its crop production?	**2.**
3. How much of an effect does PSNP support have on the quality of your HH's crop production?	**3.**
4. How much of an effect does the weather have on the quality of your HH's crop production?	**4.**
5. How much control does your HH have over the amount of food available to eat?	**5.**
6. How much of an effect does PSNP support have on the amount of food available to eat?	**6.**
7. How much of an effect does the weather have on the amount of food available to eat?	**7.**
8. How much control does your HH have over the amount of money/wealth it has?	**8.**
9. How much of an effect does PSNP support have on the amount of money/wealth your HH has?	**9.**
10. How much of an effect does the weather have on the amount of money/wealth your HH has?	**10.**

PART 14: SANITATION

A. Sanitation	
Do the children wash hands before eating every meal? (yes/no)	
Do the children wash their hands after "visiting the latrine"? (yes/no)	
Does the Mother wash her hands before every meal? (yes/no)	
Does the Mother wash her hands after "visiting the latrine"? (yes/no)	

B. Access to drinking water	
Water source	
Distance (km) to water source (one way):	
Time (minutes) to water source (one way):	
Water source: 01=protected well/pump, 02=unprotected well/pump, 03=stream or creek, 04=pond, 05=other (write-in)	

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BIBLIOGRAPHY

Aalen, Lovise. 2011. *The Politics of Ethnicity in Ethiopia: Actors, Power, and Mobilisation under Ethnic Federalism*. Leiden: Koninklijke Brill NV.

Adamo, Susana B. and Haydea Izazola. 2010. "Human Migration and the Environment." *Population and Environment* 2-3: 105-108.

Adger, W. Neil. 1999. "Social Vulnerability to Climate Change and Extremes in Coastal Vietnam." *World Development* 27: 249-269.

Adger, W. Neil. 2000. "Social and Ecological Resilience: Are They Related?" *Progress in Human Geography* 24: 347-64.

Akram-Lodhi, A. Haroon and Cristobal Kay. 2010a. "Surveying the Agrarian Question (Part 1): Unearthing Foundations, Exploring Diversity." *Journal of Peasant* Studies 37: 177-202

Akram-Lodhi, A. Haroon and Cristobal Kay. 2010b. "Surveying the Agrarian Question (Part 2): Current Debates and Beyond. *Journal of Peasant Studies* 37: 255-284

Andersson, Camilia, Alemu Mekonnen, and Jesper Stage. 2011. "Impacts of the Productive Safety Net Program in Ethiopia on Livestock and Tree Holdings of Rural Households." *Journal of Development Economics* 94: 119-126.

Barrett, Christopher B. and Michael R. Carter. 2013. "The Economics of Poverty Traps and Persistent Poverty: Empirical and Policy Implications. *The Journal of Development Studies* 49: 976-990.

Barrett, Christopher B., Francis Chabari, DeeVon Baily, Peter D. Little, and D. Layne Coppock. 2003. "Livestock Pricing in the Northern Kenyan Rangeland." *Journal of African Economies* 12: 127-155.

Barrett, Christopher B. and Mark A. Constas. 2013. "Toward a Theory of Resilience for International Development Applications." Unpublished manuscript.

Barrett, Christopher B., Thomas Reardon, and Patrick Webb. 2001. "Nonfarm Income Diversification and Household Livelihood Strategies in Rural Africa: Concepts, Dynamics, and Policy Implications." *Food Policy* 26: 315-331.

Bates, Diane C. 2002. "Environmental Refugees? Classifying Human Migration Caused by Environmental Change." *Population and Environment* 23: 465-477.

Berhanu, Wassie. 2011. "Recurrent shocks, Poverty Traps and the Degradation of Pastoralists' Social Capital in Southern Ethiopia. *African Journal of Agricultural and Resource Economics* 6: 1-15.

Bernstein, Henry. 2004. "Considering Africa's Agrarian Questions." *Historical Materialism* 12: 115-144.

Berry, Sara. 1989. Social Institutions and Access to Resources. *Africa* 59: 41-55.

Birkmann, Jorn. 2006. *Measuring Vulnerability to Natural Hazards*. New Delhi: TERI Press.

Black, Richard, Dominic Kniveton, Ronald Skeldon, Daniel Coppard, Akira Murata, and Kerstin Schmidt-Verkerk. 2008. "Demographics and Climate Change: Future Trends and their Policy Implications for Migration." Brighton: Development Research Centre on Migration, Globalisation and Poverty, University of Sussex.

Black, Richard, W. Neil Adger, Niger W. Arnell, Stefan Dercon, Andrew Geddes, and David S.G. Thomas. 2011. "The Effect of Environmental Change on Human Migration." *Global Environmental Change* 21S: S3-S11.

Bohle, Hans G., Thomas E. Downing, and Michael J. Watts. 1994. "Climate Change and Social Vulnerability: Toward a Sociology and Geography of Food Insecurity." *Global Environmental Change* 4: 37-48.

Bryant, Raymond L. 1992. "Political Ecology: An Emerging Research Agenda in Third World Studies." *Political Geography* 11(1): 12-36.

Bullard, Robert D. 2000. *Dumping in Dixie: Race, Class, and Environmental quality* (Vol. 3). Boulder, CO: Westview Press.

Campanella, Richard. 2008. *Bienville's dilemma: A Historical Geography of New Orleans*. Lafayette: Center for Louisiana Studies.

Carter, Michal R. and Christopher B. Barrett. 2006. "The Economics of Poverty Traps and Persistent Poverty: An Asset-Based Approach." *Journal of Development Studies* 42: 178-199.

Carter, Michael R. and Travis J. Lybbert. 2012. "Consumption versus Asset Smoothing: Testing the Implications of Poverty Trap Theory in Burkina Faso." *Journal of Development Economics* 99: 255-264.

Carter, Michael R., Peter D. Little, Tewodaj Mogues, and Workneh Negatu. 2007. "Poverty traps and natural disasters in Ethiopia and Honduras." *World Development* 35: 835-856.

Carr, Edward R. 2005. "Placing the Environment in Migration: Environment, Economy, and Power in Ghana's Central Region." *Environment and Planning A* 37: 925-946.

Catton, William R. and Riley E. Dunlap. 1978. "Environmental Sociology: A New Paradigm." *The American Sociologist* 13: 41-49.

Central Statistical Agency. 2007. *Population and Housing Census Report, Country, 2007*. Addis Ababa: Central Statistical Agency.

Central Statistical Agency. 2013. "Section B: Population. "*Population Statistics Abstract*. Addis Ababa: Central Statistical Agency (Ethiopia).

Central Statistical Agency and ORC Macro. 2006. *Ethiopia: Demographic and Health Survey 2005*. Addis Ababa, Ethiopia and Calverton, Maryland, USA: Central Statistical Agency and ORC Macro.

Central Statistical Agency and ICF International. 2012. *Ethiopia: Demographic and Health Survey 2011*. Addis Ababa, Ethiopia and Calverton, Maryland, USA: Central Statistical Agency and ORC Macro.

Chambers, Robert. 2006 "Vulnerability, Coping, and Policy." *IDS Bulletin* 37: 33-40.

Chilonda, Pius and Joachim Otte. 2006. "Indicators to Monitor Trends in Livestock Production at National, Regional, and International Levels." *Livestock Research for Rural Development* 18: *117*.

Cleaver, Frances. 2005. "The inequality of Social Capital and the Reproduction of Chronic Poverty." *World Development* 33: 893-906.

Corbett, Jane. 1988. "Famine and Household Coping Strategies." *World Development* 16: 1099-1112.

Coudoul, Aline, Jesko S. Hentschel, and Quentin T. Wodon. 2002. "Poverty Measurement and Analysis." Pp. 29-74 in *Poverty Reduction Strategic Papers Sourcebook*. Washington, DC: World Bank.

Crewett, Wibke, Ayalneh Bogale, and Benedikt Korf. 2008. "Land Tenure in Ethiopia: Continuity and Change, Shifting Rules, and the Quest for State Control." CAPRI Working Paper No. 91. Washington, DC: International Food Policy Research Institute.

Cronon, William. 1991. *Nature's Metropolis: Chicago and the Great West*. New York: W.W. Norton & Company.

Crowder, Kyle and Liam Downey. 2010. "Inter-neighborhood Migration, Race, and Environmental Hazards: Modeling Microlevel Processes of Environmental Inequality. *The American Journal of Sociology* 115: 1110-1149.

Cutter, Susan L. and Christina Finch. 2008. "Temporal and Spatial Changes in Social Vulnerability to Natural Hazards." *PNAS* 105: 2301-2306.

Cutter, Susan L., Bryan J. Boruff, and W. Lynn Shirley. 2003. "Social Vulnerability to Environmental Hazards." *Social Science Quarterly* 84: 242-261.

Dannefer, Dale. "Cumulative Advantage/Disadvantage and the Life Course: Cross-Fertilizing Age and Social Science Theory." *The Journals of Gerontology*. 58: S327-S337.

Dercon, Stefan, John Hoddinott, and Tassew Woldehanna. 2005. "Shocks and Consumption in 15 Ethiopian Villages, 1999-2004." *Journal of African Economies* 14: 559-585.

De Frenne, Pieter, Francisco Rodríguez-Sánchez, David Anthony Coomes, Lander Baeten, Gorik Verstraeten, Mark Vellend, …, and Kris Verheyen. 2013. "Microclimate Moderates Plant Responses to Macroclimate Warming." *PNAS* 110: 18561-18565.

De Haas, Hein. 2010. "Migration and Development: A Theoretical Perspective." *International Migration Review* 44: 1-38.

Desai, Jaikishan and Alessandro Tarozzi. 2011. "Microcredit, Family Planning Programs, and Contraceptive Behavior: Evidence From a Field Experiment in Ethiopia." *Demography* 48: 749-782.

Devereux, Stephen. 2011. "Sen's Entitlement Approach: Critiques and Counter-critiques." *Oxford Development Studies* 29: 245-263.

De Waal, Alex. 2005. *Famine that Kills: Darfur, Sudan*. New York: Oxford University Press.

DiPrete, Thomas A. and Gregory M. Elrich. 2006. "Cumulative Advantage as a Mechanism for Inequality: A Review of Theoretical and Empirical Developments." *Annual Review of Sociology* 32: 271-297.

Dorosh, Paul and Emily Schmidt. 2010. "The Rural-Urban Transformation in Ethiopia." IFPRI ESSP2 Working Paper No 13. Addis Ababa, Ethiopia: IFPRI.

Doss, Cheryl, John McPeak, and Christopher B. Barrett. 2008. "Interpersonal, Intertemporal, and Spatial Variation in Risk Perceptions: Evidence from East Africa." *World Development* 36: 1453-1468.

Dunlap, Riley E. 2010. "Climate Change and Rural Sociology: Broadening the Research Agenda." *Rural Sociology* 75: 17-27.

Dunlap, Riley E. and Brent K. Marshall. 2007. "Environmental Sociology." Pp. 329-40 in *21st Century Sociology*, Edited by Clifton D. Bryant and Dennis L. Peck. Thousand Oaks, CA: Sage.

Ellis, Frank. 1998. Household Strategies and Rural Livelihood Diversification. *The Journal of Development Studies* 35: 1-38.

Erikson, Kai T. 1976. *Everything in its Path: Destruction of Community in the Buffalo Creek Flood*. New York: Simon & Schuster.

Ezra, Markos. 2001. "Demographic Responses to Environmental Stress in the Drought- and Famine-Prone Areas of Northern Ethiopia. *International Journal of Population Geography* 7: 259-279.

Fafchamps, M., Udry, C., & Czukas, K. 1998. "Drought and Saving in West Africa: Are Livestock a Buffer Stock? *Journal of Development Economics* 55: 273-305.

FEWSNET. 2011. "ETHIOPIA Food Security Outlook Update: Below-Average February to May Rains Increase Food Security Concerns." Accessed 11 June 2014. Available at: http://www.fews.net/sites/default/files/documents/reports/ethiopia_FSOU_0506_2011.pdf

FEWSNET. 2012. "ETHIOPIA Food Security Outlook Update: Food Security Concerns Persist Due to Below-Average February to May Rains." Accessed 11 June 2014. Available at: http://www.fews.net/sites/default/files/documents/reports/ethiopia_FSOU_05_2012_final.pdf

Firebaugh, Glenn. 1999. "Empirics of World Income Inequality." *American Journal of Sociology* 104: 1597-1630.

Foresight. 2011. *Migration and Global Environmental Change: Future Challenges and Opportunities: Final Project Report*. London: The Government Office for Science.

Fratkin, Elliot and Eric A. Roth. 1990. "Drought and Economic Differentiation Among Ariaal Pastoralists of Kenya." *Human Ecology* 18: 385- 402.

Gemene, Francois. 2011. "Why the Numbers Don't Add Up. A Review of Estimates and Predictions of People Displaced by Environmental Change." *Global Environmental Change* 21: S41-S49.

Goldman, Michael and Rachel A. Schurman. 2000. "Closing the 'Great Divide': New Social Theory on Society and Nature." *Annual Review of Sociology* 26: 563-84.

Gray, Clark. 2009. "Environment, Land, and Rural Out-migration in the Southern Ecuadorian Andes." *World Development* 37: 457-468.

Gray, Clark and Valerie Mueller. 2012a. "Drought and Population Mobility in Rural Ethiopia." *World Development* 40: 134-45.

Gray, Clark and Valerie Mueller. 2012b. "Natural Disasters and Population Mobility in Bangladesh." *PNAS* 109: 6000-6005.

Gray, Clark and Richard Bilsborrow. 2013. "Environmental Influences on Human Migration in Rural Ecuador." *Demography* 50: 1217-41.

Gray, Leslie and Brian Dowd-Uribe. 2013. "A Political Ecology of Socio-Economic Differentiation: Debt, Inputs, and Liberalization Reforms in Southwestern Burkina Faso." *The Journal of Peasant Studies* 40: 683-702.

Groen, Jeffrey A., and Anne E. Polivka. 2010 "Going Home after Hurricane Katrina: Determinants of Return Migration and Changes in Affected Areas." *Demography* 47: 821-844

Grusky, David B., Manwai C. Ku, and Szonja Szelenyi. 2008. *Social Stratification: Class, Race, and Gender in Sociological Perspective*. Boulder: Westview Press.

Hammond, Laura. 2008. "Strategies of Invisibilization: How Ethiopia's Resettlement Programme Hides the Poorest of the Poor." *Journal of Refugee Studies* 21: 517-536

Hampshire, Katherine, Rachel Casiday, Kate Kilpatrick, and Catherine Panter-Brick. 2009. "The Social Context of Childcare Practices and Child Malnutrition in Niger's Recent Food Crisis. *Disasters* 33: 132-151.

Helgeson, Jennifer F., Simon Dietz, and Stefan Hochrainer-Stigler. 2013. "Vulnerability to Weather Disasters: The Choice of Coping Strategies in Rural Uganda." *Ecology & Society* 18: 202-214.

Hoddinott, John. 2006. "Shocks and their Consequences Across and Within Households in Rural Zimbabwe." *Journal of Development Studies* 42: 301-321.

Hirvonen, Kalle. 2014. "Temperature changes, household consumption and internal migration: Evidence from Tanzania." Unpublished manuscript.

Hoddinott, John and Bill Kinsey. 2001. "Child Growth in the Time of Drought. *Oxford Bulletin of Economics and Statistics* 63: 409-436.

Janssens, Wendy. 2006. *Social Capital and Cooperation: An Impact Evaluation of a Women's Empowerment Programme in Rural India*. Tinbergen Institute Research Series No. 401. Thesis.

Karfakis, Panagiotis, Leslie Lipper, and Mark Smulers. 2012. "The Assessment of the Socio-Economic Impacts of Climate Change at Household Level and Policy Implications." Pp. 133-150 in *Building Resilience for Adaptation to Climate Change in the Agricultural Sector,* Edited by Alexandre Meybeck, Jussi Lankosi, Suzanne Redfern, Nadine Azzu, and Vincent Gitz. Proceedings of a Joint FAO/OECD Workshop, 23-24 April 2012. Rome: FAO and OECD.

Keister, Lisa A., and Stephanie Moller. 2000. "Wealth Inequality in the United States." *Annual Review of Sociology* 26: 63-81.

Kinsey, Bill, Kees Burger, and Jan Willem Gunning. 1998. "Coping with Drought in Zimbabwe: Survey Evidence on Responses of Rural Households to Risk. *World Development* 26: 89-110.

Klinenberg, Eric. 1999. "Denaturalizing Disaster: A Social Autopsy of the 1995 Chicago Heat Wave." *Theory and Society* 28: 239-295.

Lawson, David and Ibrahim Kasirye. 2013. "How the Extreme Poor Cope with Crises: Understanding the Role of Assets and Consumption." *Journal of International Development* 25: 1129-1143.

Leach, Melissa, Robin Mearns, and Ian Scoones. 1999. "Environmental Entitlements: Dynamics and Institutions in Community-Based Natural Resource Management." *World* Development 27: 255-247.

Lee, Myoung-jae and Changhui Kang. 2006. "Identification for Difference in Differences with Cross-Section and Panel Data." *Economics Letters* 92: 270-276.

Lindstrom, David P. and Betemariam Berhanu. 1999. "The Impact of War, Famine, and Economic Decline on Marital Fertility in Ethiopia." *Demography* 36: 247-261.

Little, Peter D., M. Priscilla Stone, Tewodaj Mogues, A. Peter Castro, and Workneh Negatu. 2006. "Moving in Place: Drought and Poverty Dynamics in South Wollo, Ethiopia. *Journal of Development Studies* 42: 200-225.

Livelihoods Integration Unit. 2010. *An Atlas of Ethiopian Livelihoods*. Washington, DC: USAID.

Lucas, Robert E.B. and Oded Stark. 1985. "Motivations to Remit: Evidence from Botswana. *Journal of Political Economy* 93: 901-918.

Lybbert, Travis J., Christopher B. Barrett, Solomon Desta, and D. Layne Coppock. 2004. "Stochastic Wealth Dynamics and Risk Management among a Poor Population." *The Economic Journal* 114: 750-777.

Maccini, Sharon and Dean Yang. 2009. "Under the Weather: Health, Schooling, and Economic Consequences of Early-Life Rainfall." *American Economic Review* 99: 1006-1026.

Massey, Douglas S. 1998. "Economic Development and International Migration in Comparative Perspective." *Population and Development Review* 14: 383-413.

Massey, Douglas S., William G. Axinn, and Dirgha J. Ghimire. 2010. "Environmental Change and Out-Migration: Evidence from Nepal." *Population and Environment* 23: 109-136.

Maxwell, Daniel G. 1996. "Measuring Food Insecurity: The Frequency and Severity of Coping Strategies." *Food Policy* 21(3): 291-303.

Maxwell, Daniel and Richard Caldwell. 2008. *The Coping Strategies Index: A Tool for Rapid Measurement of Household Food Security and the Impact of Food Aid Programs in Humanitarian Emergencies*. Atlanta, GA: Cooperative for Assistance and Relief Everywhere (CARE), Inc.

McKenzie, David J. 2005. "Measuring Inequality with Asset Indicators. *Journal of Population Economics* 18: 229-260.

McLaughlin, Paul and Thomas Dietz. 2008. "Structure, Agency, and Environment: Toward an Integrated Perspective on Vulnerability." *Global Environmental Change* 18: 99-111.

McPeak, John G., Peter D. Little, and Cheryl R. Doss. 2012. *Risk and Social Change in an African Rural Economy*. New York: Routledge.

Mengisteab, Kidane. 1997. "New Approaches to State Building in Africa: The Case of Ethiopia's Ethnic-Based Federation." *African Studies Review* 40: 111-132.

Merton, Robert K. 1973. "The Matthew Effect in Science." Pp. 439-59 in *The Sociology of Science,* Edited by Norman W. Storer. Chicago: University of Chicago Press.

Mertz, Ole, Cheikh Mbow, Anette Reenberg, and Awa Diouf. 2009. "Farmers' Perceptions of Climate Change and Agricultural Adaptation Strategies in Rural Sahel." *Environmental Management* 43: 804-816.

Michelson, Hope, Maria Muñiz, and Kyle DeRosa (2013). "Measuring Socio-economic Status in the Millennium Villages: The Role of Asset Index Choice." *The Journal of Development Studies* 49: 917-935

Mogues, Tewodaj. 2006. "Shocks, Livestock Asset Dynamics, and Social Capital in Ethiopia." International Food Policy Research Institute (IFPRI) Development Strategy and Governance Division Discussion Paper No. 38. Washington, DC: IFPRI.

Mogues, Tewodaj and Michael Carter. 2005. "Social Capital and the Reproduction of Economic Inequality in Polarized Societies." *The Journal of Economic Inequality* 3: 193-219.

Montgomery, Mark R., Michele Gragnolati, Kathleen A. Burke, and Edmundo Paredes. 2000. "Measuring Living Standards with Proxy Variables. *Demography* 37: 155-174.

Morduch, Jonathan. 1995. "Income Smoothing and Consumption Smoothing." *The Journal of Economic Perspectives* 9: 103-114.

Morrow, Betty Hearn. 1999. "Identifying and Mapping Community Vulnerability" *Disasters* 23: 1-18.

Mueller, Valerie, Clark Gray, and Katrina Kosec. 2014. "Heat Stress Increases Local-Term Human Migration in Rural Pakistan." *Nature Climate Change* 4: 182-185.

NASA. (2012). *Prediction of Worldwide Energy Resource (POWER): Agroclimatology Methodology*. Version 1.0. Available at: http://power.larc.nasa.gov/documents/Agroclimatology_Methodology.pdf. Accessed 6 June 2013.

Neckerman, Kathryn M. and Florencia Toche. 2007. "Inequality: Causes and Consequences." *Annual Review of Sociology* 33: 335-57.

Oppenshaw, Stan. 1983. *The Modifiable Areal Unit Problem*. Norwich: Geo Books.

Pais, Jeremy, Kyle Crowder, and Liam Downey. 2013. "Unequal Trajectories: Racial and Class Differences in Residential Exposure to Industrial Hazard." *Social Forces*. DOI: 10.1093/sf/sot099.

Platteau, Jean-Philippe. 1995. "A Framework for the Analysis of Evolving Patron-Client Ties in Agrarian Economies." *World Development* 23: 767-786.

Porter, Gina. 2002. "Living in a Walking World: Rural Mobility and Social Equity Issues in Sub-Saharan Africa." *World Development* 30: 285-300.

Reardon, Thomas and J. Edward Taylor. 1996. "Agroclimatic Shock, Income Inequality, and Poverty: Evidence from Burkina Faso." *World Development* 24: 901-914.

Renaud, Fabrice G., Olivia Dun, Koko Warner, and Janos Bogardi. 2011. "A Decision Framework for Environmentally Induced Migration." *International Migration* 49: e5-e29.

Rienecker, Michele M., Max J. Suarez, Ronald Gelaro, Ricardo Todling, Julio Bacmeister, …, and Jack Woollen. 2011. "MERRA: NASA's Modern-Era Retrospective Analysis for Research and Applications." *Journal of Climate* 24: 3624-3648.

Roncoli, Carla, Keith Ingram, and Paul Kirshen. 2001. "The Costs and Risks of Coping with Drought: Livelihood Impacts and Farmers' Responses in Burkina Faso." *Climate Research* 19: 119-132.

Rosenzweig, Mark R. and Oded Stark. 1989. "Consumption Smoothing, Migration, and Marriage: Evidence from rural India. *Journal of Political Economy* 97: 905-926.

Ruben, Ruerd and Edward Masset. 2003. "Land Markets, Risk, and Distress Sales in Nicaragua: The Impact of Income Shocks on Rural Differentiation." *Journal of Agrarian Change* 3: 481-99.

Sabates-Wheeler, Rachel, and Stephen Devereux. 2010. "Cash Transfers and High Food Prices: Explaining Outcomes on Ethiopia's Productive Safety Net Programme." *Food Policy* 35: 274-285.

Sahn, David E. and David C. Stifel. 2000. "Poverty comparisons over time and across countries in Africa." *World Development*, 28(12), 2123-2155.

Sahn, David E. and David C. Stifel. 2003. "Urban-Rural Inequality in Living Standards in Africa." *Journal of African Economies* 12: 563-597.

Santos, Paulo and Christopher B. Barrett. 2006. "Heterogeneous Wealth Dynamics: On the Roles of Risk and Ability." Unpublished manuscript.

Scoones, Ian. 1997. "The Dynamics of Soil Fertility Change: Historical Perspectives on Environmental Transformation from Zimbabwe." *The Geographic Journal* 163: 161-169.

Scott, James C. 1977. *The Moral Economy of the Peasant: Rebellion and Subsistence in Southeast Asia*. New Haven, CT: Yale University Press.

Sen, Amartya. 1976. "Famines as Failures of Exchange Entitlements." *Economic and Political Weekly* 11: 1273-1280.

Sen, Amartya. 1981. *Poverty and Famines: An Essay on Entitlement and Deprivation*. New York: Oxford University Press.

Shapiro, David and Tesfayi Gebreselassie. 2008. "Fertility Transition in Sub-Saharan Africa: Falling and Stalling." *African Population Studies* 23: 3-23.

Shove, Elizabeth. 2010. "Beyond the ABC: Climate Change Policy and Theories of Social Change." *Environment and Planning A* 42: 1273-1285.

Smith, Kevin, Christopher B. Barrett, and Paul W. Box. 2000. "Participatory Risk Mapping for Targeting Research and Assistance: With an Example from East African Pastoralists." *World Development* 28: 1945-1959.

Stark, Oded and David E. Bloom. 1985. "The New Economics of Labor Migration." *The American Economic Review* 75: 173-78.

Tadesse, Fanaye and Derek Headey. 2012. "Urbanization and Fertility Rates in Ethiopia." ESSP II Working Paper No. 35. Addis Ababa: International Food Policy Research Institute.

Tareke, Gebru. 2009. *The Ethiopian Revolution: War in the Horn of Africa*. New Haven: Yale University Press.

Theirfelder, Christian, Stephanie Cheesman, and Leonard Rusinamhodzi. 2013. "Benefits and Challenges of Crop Rotation in Maize-Based Conservation Agriculture (CA) Cropping Systems of Southern Africa." *International Journal of Agricultural Sustainability* 11: 108-124.

Thiede, Brian C. and David L. Brown. 2013. "Hurricane Katrina: Who Stayed and Why?" *Population Research and Policy Review*. 32(6): 803-824.

Tierney, Kathleen. 2006. "Social Inequality, Hazards, and Disasters." Pp. 109-128 in *On Risk and Disaster: Lessons from Hurricane Katrina*, Edited by Ronald J. Daniels, Donald F. Kettl, and Howard Kunreuther. Philadelphia: University of Pennsylvania Press.

Tilahun, Helina and Emily Schmidt. 2012. "Spatial Analysis of Livestock Production Patterns in Ethiopia." Ethiopia Strategy Support Program II Working Paper 44.

Tschakert, Petra. 2007. "Views from the Vulnerable: Understanding Climatic and Other Stressors in the Sahel." *Global Environmental Change* 17: 381-396.

United States Geological Survey (USGS). 2012. "A Climate Trend Analysis of Ethiopia." Washington, DC: Department of the Interior.

Watts, Michael J. and Hans G. Bohle. 1993. "The Space of Vulnerability: The Causal Structure of Hunger and Famine." *Progress in Human Geography* 17: 43-67.

Valentine, Theodore R. 1993. "Drought, Transfer Entitlements, and Income Distribution: The Botswana Experience." *World Development* 21: 109-126.

Viste, Ellen, Diriba Korecha, and Asgeir Sorteberg. (2013). Recent Drought and Precipitation Tendencies in Ethiopia. *Theoretical and Applied Climatology* 112: 535-551.

Watts, Michael J. 2013. *Silent Violence: Food, Famine, and Peasantry in Northern Nigeria*. Athens: University of Georgia Press.

Watts, Michael J. and Hans G. Bohle. 1993. "The Space of Vulnerability: The Causal Structure of Hunger and Famine." *Progress in Human Geography* 17: 43-67.

Webb, Patrick and Thomas Reardon. 1992. "Drought Impact and Household Responses in East and West Africa." *Quarterly Journal of International Agriculture* 31: 230-246.

Wilson, Andrea E., Kim W. Shuey, and Glen H. Elder, Jr. 2007. "Cumulative Advantage Processes as Mechanisms of Inequality in Life Course Health." *American Journal of Sociology* 112: 1886-1924.

Wisner, Ben, Piers Blaikie, Terry Cannon, and Ian Davis. 2004. *At Risk: Natural Hazards, People's Vulnerability, and Disasters*. New York: Routledge.

Woodgate, Graham and Michael Redclift. 1998. "From a 'Sociology of Nature' to Environmental Sociology: Beyond Social Construction." *Environmental Values* 7: 3-24.

Woolcock, Michael. 1998. "Social Capital and Economic Development: Toward a Theoretical Synthesis and Policy Framework." *Theory and Society* 27: 151-208.

Yearly, Steven. 2009. "Sociology and Climate Change after Kyoto: What Roles for Social Science in Understanding Climate Change?" *Current Sociology* 57: 389-405.

Zimmerman, Frederick J. and Michael R. Carter. 2003. "Asset Smoothing, Consumption Smoothing and the Reproduction of Inequality under Risk and Sustenance Constraints." *Journal of Development Economics* 71: 223-260.