

Gendered Scripts and Declining Soil Fertility in Southern Ethiopia

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Abstract: Enset (*Ensete ventricosum*) is a banana-like plant grown throughout the Southern Highlands of Ethiopia as the major staple food crop by many cultural groups. The issue of soil fertility among enset-growing farmers of Sidama, located in the Southern Region of Ethiopia, is embedded within the larger process of how a household makes a living. The traditional Sidama enset production and processing script presented in this paper describes how enset production and processing fit into the larger household livelihood process. Enset growing households of Southern Ethiopia have undergone a gradual process of impoverishment over the past three decades. This erosion of household assets has tested the ability of the enset script to continue to meet culturally established and emerging household consumption objectives. While socioeconomic production conditions and household objectives have dramatically changed, the traditional enset production and processing rules have not kept pace. The impact of insufficient enset script adaptation on female-headed households is examined. The argument is made that the enset production script must be modified through farmer planning to be able to meet existing (and anticipated future) household consumption objectives under new socioeconomic conditions. It is argued that new soil improvement technologies, which will be an important part of this new, modified enset script, must be evaluated in terms of how they fit into the larger household livelihood system. It is concluded that participatory farmer planning is necessary to help households adapt the existing enset script to address changes in socioeconomic conditions and to meet changing household objectives.

Introduction

The main purpose of this paper is to highlight the need for analyzing soil fertility management and the adoption of soil improvement technologies among small farmers as only one aspect in the larger process of how households make a living. To illustrate how soil fertility management practices and household livelihood strategies in Sidama are intertwined, the increasing inability of the traditional Sidama enset production and processing script to meet existing household objectives under changing socioeconomic conditions will be analyzed. Particular attention will be given to the impact on female-headed households (FHHs). Studies conducted throughout Africa and the rest of the world show that FHHs are typically poorer, have less adult labor, grow relatively more subsistence crops than cash crops and in general have less access to financial and physical capital.¹ The final section of the article will examine some of the lessons learned from the analysis of scripts and suggest how these lessons can help future soil fertility improvement programs better achieve their goals of increasing food security.

<http://www.africa.ufl.edu/asq/v6/v6i1-2a5.pdf>

To analyze how soil fertility management is embedded within the household livelihood system, this paper employs the sustainable livelihoods analysis framework in the description of Sidama enset production and processing and the impact on FHHs.² The sustainable livelihoods framework highlights the need to examine the complex ways that people make a living given their assets and cultural, political, economic, and environmental contexts when designing development policy. The sustainable livelihoods framework emphasizes examination in five categories of inquiry:

- ⊙ contexts, conditions and trends
- ⊙ livelihood resources
- ⊙ institutional processes and organizational structures
- ⊙ livelihood strategies
- ⊙ sustainable livelihood outcomes.³

This paper will cover only four of these five categories. Category three, institutional processes & organizational structures, will not be discussed here. Contexts, conditions and trends and livelihood resources will be briefly discussed to familiarize the reader with the Sidama enset production system. Livelihood strategies will be discussed using the example of the Sidama enset production and processing script. Livelihood outcomes will be examined using a brief case study of a FHH in Sidama.

Sidama soil fertility management practices are embedded within a complex set of gendered cultural rules, guidelines, standard operating procedures, or what Schank and Ableson describe as scripts.⁴ It is argued here that these scripts are detailed representations of specific household livelihood strategies. As will be seen below, scripts provide a representation of household livelihood strategies in vivid detail, yielding important descriptive cultural information about how activities are completed, who is involved, and highlight the complex contingencies contained in household livelihood strategies. As will be seen below, scripts can be nested hierarchically with embedded decision points. The gendered relationships of household livelihood strategies that scripts represent provide an important tool for examining adoption and adaptation of soil fertility improvement technologies.

METHODOLOGY

The data on scripts and the gender division of labor used in this study is drawn from primary data from case studies of ten Sidama households in two communities conducted by the author and Degife Shibru in 2001. Due to the detail of the production data required for this study a case study research design was used. A snowball sampling procedure was used to select five households within each of the two study communities. Due to this research design, the conclusions drawn in this paper are based on the processes observed working in ten households in two communities and may be suggestive of processes operating on a wider scale.

Determining the generalizability of this paper's conclusions is left to other studies with generalizability as their express concern.

Descriptive secondary data is drawn with permission from an unpublished region-wide food security survey of Sidama (n=270 households) conducted by Degife Shibru in 2000 for the Sidama Zone Bureau of Agriculture.⁵ A stratified random sampling design was used to represent households within the three major agroecological zones (lowland, midland, highland) of the Sidama Zone.⁶

GENDER ISSUES WITHIN THIS FRAMEWORK

This paper will discuss men and women's production roles, the gender division of labor, the gender division of skills and cultural knowledge, and gendered access to capital within the enset system. Discussion of these issues is necessary to understand the relationship between the process of soil fertility decline and households' choice of livelihood strategy, specifically enset production and processing activities. Understanding the connection between the process of soil fertility decline and choice of livelihood strategy is necessary for the design of effective policy to address food security. As will be seen by the case study of a FHH, the food security of this household, through the livelihood strategies it chose, is integrated in a community-wide process of enset land soil fertility decline.

WHAT ARE SCRIPTS?

People need cognitive tools to assist them in figuring out how to make a living in their complex and uncertain worlds. To help in this process, people create scripts to simplify and codify complex cultural information. Schank and Abelson define a script as "a predetermined, stereotyped sequence of actions that defines a well-known situation . . . a structure that describes appropriate sequences of events in a particular context."⁷ People are usually unaware that these scripts even exist. They simply use them to complete everyday tasks. Complex localized agricultural production knowledge gradually becomes transformed into scripts as particular combinations of techniques are proven to be successful over time. Chayanov points out that to make a living, households must decide how to apply available resources to existing activities to meet their objectives, however these objectives are defined.⁸ Scripts represent the standard operating procedures that people use to guide how they will make these important livelihood decisions.

Script formation helps to simplify the complicated web of interrelated factors into an easy to follow sequence of actions. Scripts are the result of a gradual distillation of the process down to its essential steps by generations of users. The script user is freed from having to think about the myriad factor dependencies involved in getting a particular job done. One need only follow the steps in the script. A script is practical and results oriented, hiding most of the logic from the user. The script has proven successful to others in the past and therefore the user need not spend time contemplating the complex underlying procedural details. This freeing of cognitive resources is one of the primary functional purposes of scripts.

An important aspect of scripts is that they embody generations worth of successful indigenous knowledge. Scripts have been developed over time, being incrementally adapted

and handed down through the generations as a proven set of successful standard operating procedures that have met the socioeconomic and environmental conditions experienced in the past. Scripts of important activities are diligently taught by parents and learned by children. These scripts are important pieces of technological and cultural information. However, individuals are not inextricably bound by culture to follow these scripts. Often, pioneering individuals deviate from these scripts for a broad range of reasons.⁹

The scripts that people use everyday are usually preconscious or preattentive and are typically not written down on paper (writing being done almost exclusively by researchers).¹⁰ The term “script” as used in this paper refers both to the preconscious, preattentive set of instructions that people use to get a job done (emic) and to the written form usually created only by researchers to represent peoples’ preconscious instruction set (etic). Because of the tremendous amount of cultural information contained in these preconscious scripts, the creation a written form of these scripts by researchers can be an important tool for documenting household livelihood strategies.

A TYPOLOGY OF LIVELIHOOD STRATEGIES

Livelihoods are constructed as a portfolio of activities.¹¹ Livelihood strategies represent a web of choices individuals and groups make about how to make a living and are based on people’s perceptions of how a mix of available activities can best meet their objectives with existing assets, in a particular context.¹² Steven Devereux has proposed a series of categories that form a continuum of livelihood strategies.¹³

“Poor households everywhere survive by pursuing a mix of livelihood strategies that seek to increase their income flows and stocks of assets (accumulation strategies), to spread risk through livelihood adjustments or income diversification (adaptive strategies), to minimize the impacts of livelihood shocks (coping strategies) and, *in extremis*, to prevent destitution and death (survival strategies).”¹⁴

For the purpose of this paper, one useful way of viewing this series of categories is as a continuum of asset accumulation.¹⁵ At the ‘positive’ end (in terms of livelihood sustainability) of the continuum accumulation strategies gain assets, adaptive strategies may gain or lose assets, while both coping and survival strategies lose assets. Devereux makes the observation that non-erosive dis-accumulation often takes place in the coping category while erosive disaccumulation takes place in the survival category.¹⁶

Hussein and Nelson organize livelihood strategies differently, creating three categories: intensification, diversification, and migration.¹⁷ However, this author proposes that intensification, diversification, and migration should not be seen as categories of livelihood strategies but as dimensions of particular strategies. When making livelihood decisions, individuals and households face a choice about whether to intensify or dis-intensify (extensify in the case of using more land in agriculture) production of a particular activity, regardless of whether it is an accumulation strategy or a survival strategy. Likewise in the case of diversification, when individuals and households consider their portfolio of activities they are also faced with the decision to diversify or specialize (which is independent of the decision to intensify/dis-intensify a particular activity). Finally, individuals and households must make a choice about the location of each activity.¹⁸

Livelihood strategies can also be discussed in terms of the institutional scales of a particular strategy. Five scales are commonly identified: intra-household, inter-household, community, market, and state. Table 1 groups examples of Sidama coping and survival strategies to food shortage into these five scale levels. Each of the livelihood strategy examples categorized into each of the five scale levels can be classified as either accumulative, adaptive, coping, or a survival strategy depending on the particular context of the household. As will be explained further in the case study, processing enset for other households could at one time be considered an adaptive strategy while at another time be considered a coping or survival strategy.

Table 1. Institutional scales of livelihood strategies. (adapted from Degife, 2001, p. 93)

Intra-household	<ul style="list-style-type: none"> diversify crop and livestock activities reduce consumption go without food eat wild crops process immature enset for consumption use own financial resources migrate (temporarily or permanently)
Inter-household	<ul style="list-style-type: none"> seek support from relatives share food, land, labor, equipment, or animals process enset for others
Community	<ul style="list-style-type: none"> participate in mutual-assistance organizations (idir, ayde, seera)
Market	<ul style="list-style-type: none"> do petty trading produce and sell rural crafts purchase food in market sell animals sell fuel wood and livestock grass sell immature coffee on the tree borrow money
State	<ul style="list-style-type: none"> receive famine relief participate in rehabilitation and development projects

Many coping and survival strategies are forms of informal safety nets.¹⁹ Coping and survival strategies often involve simply the intensification of existing activities rather than engagement in new activities.²⁰ The strategies chosen as stress increases follow a predictable sequence based on the cost and reversibility of the action.²¹ Informal safety nets are often based on patron-client relationships. The redistribution of wealth that these relationships provide are important coping and survival strategies for vulnerable groups such as FHHs.

STUDY AREA

The households interviewed for this study are located in the west-central part of the Sidama Zone of the Southern Region of Ethiopia. Sidama is both the name of the administrative unit and the Sidama ethnic group. The Sidama Zone is 7,672 square kilometers and the population is approximately 2.8 million people of which 94% of *kebeles* (smallest Ethiopian administrative district) are classified as rural.²² The study area is commonly divided into three agroecological zones.²³ The semiarid lowland (Amharic: *qola*) of the Rift Valley comprises 30% of Sidama (1200-1500 meters above sea level; 400-800 mm average annual rainfall; 20.0-24.9E C average annual temperature range). The moist mid-altitude (Amharic: *woinadega*) comprises 54% of Sidama (1500-2300 masl, 1200-1600 mm average annual rainfall, 15.0-19.9E C average annual temperature range). The cool moist highland (Amharic: *dega*) comprises 16% of Sidama (2300-3500 masl, 1600-2000 mm average annual rainfall, 15.0-19.5E C average annual temperature range). The study sites are located in the *woinadega* areas of Shebedino and Dale *Woredas* (roughly a county-sized administrative district), approximately 30 miles south of the capital city of the Southern Region, Awasa. Rainfall tends to be bimodal (main rains: June-September, short rains: mid February-March) with rainfall becoming more continuous as elevation increases. However, the short rains are highly variable and since they often fail, farmers claim they are relying on them for grain production less and less.

Figure 1. Map of Ethiopia.

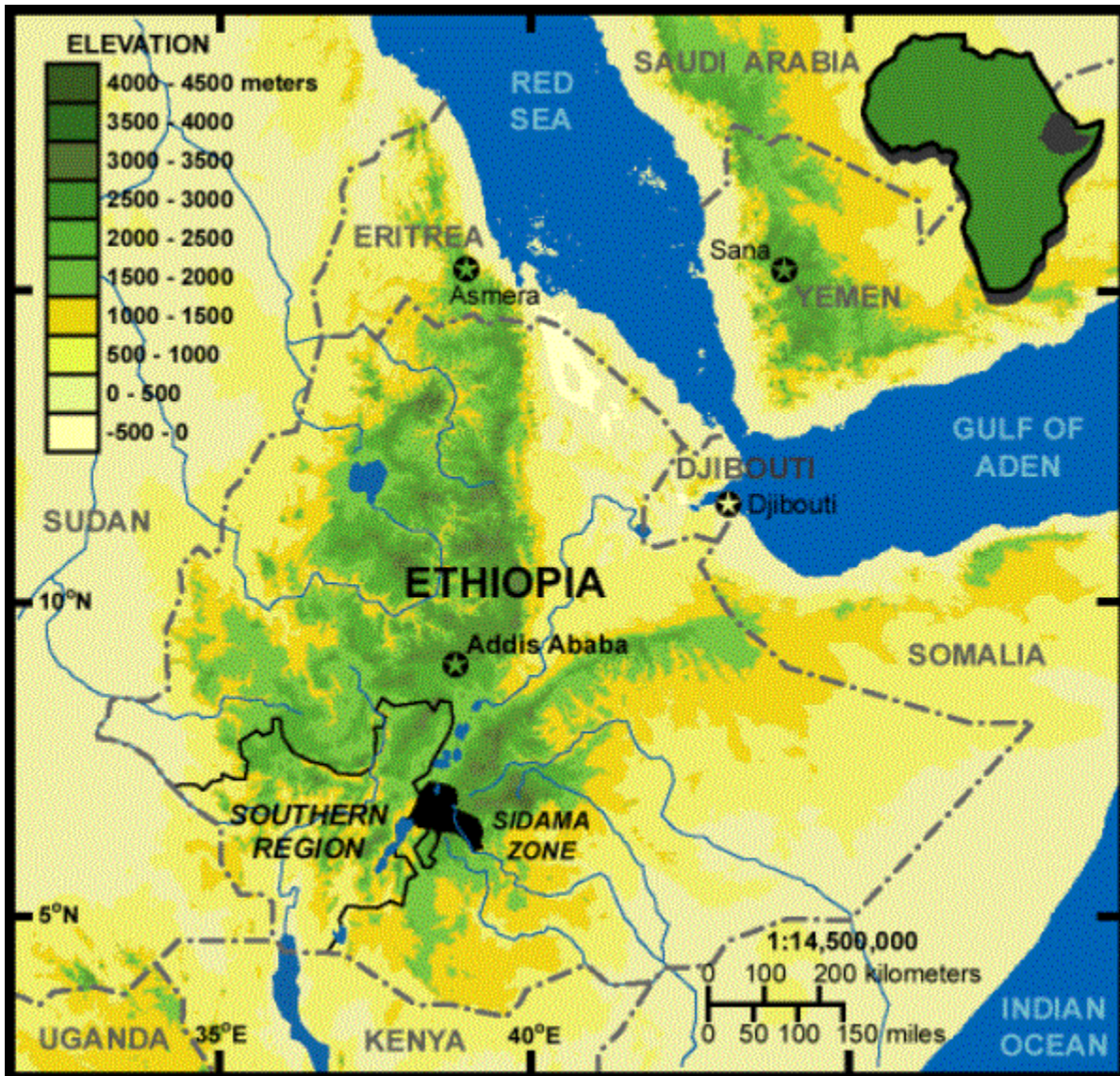
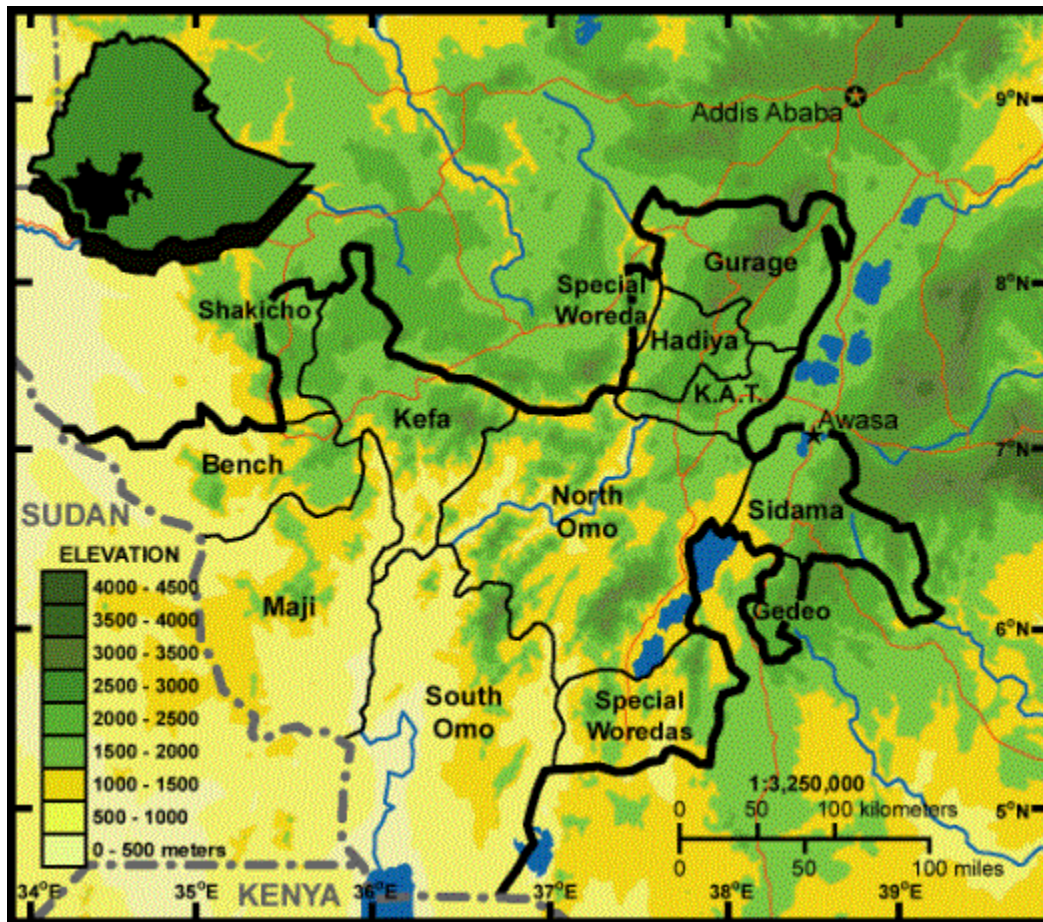


Figure 2. Map of Southern Region.

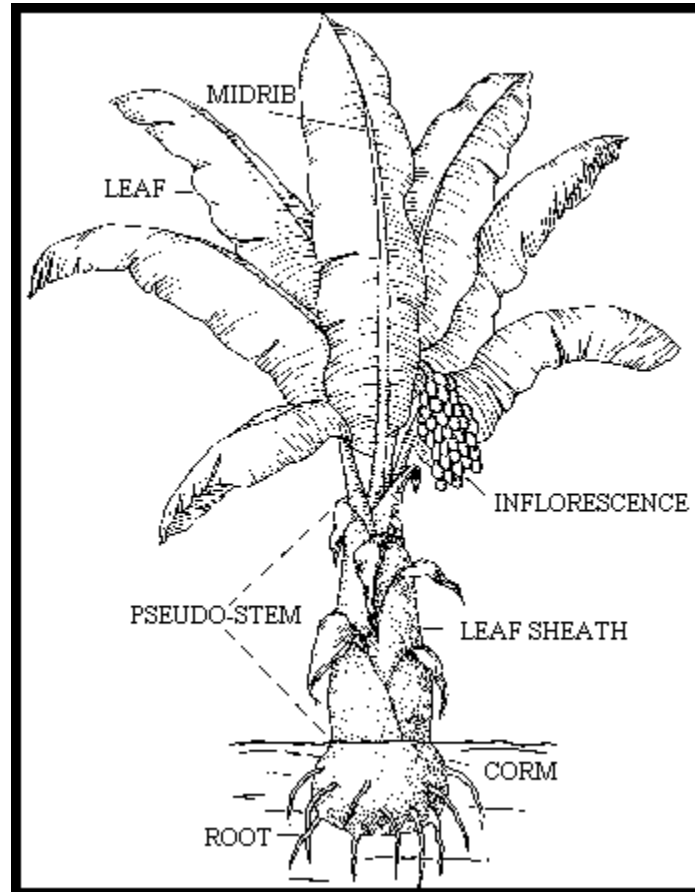


DESCRIPTION OF ENSET

Enset (*Ensete ventricosum*), is a long-lived, banana-like perennial plant used for food, fodder and fiber throughout the Southern Highlands of Ethiopia.²⁴ The part of the plant that is used for human consumption is not the fruit, but the enlarged pseudostem and underground corm that swell over time with carbohydrates. The leaves are mainly used for fodder and the fibrous pseudostem can be processed for fiber. Enset products are used for everything from food wrapping to medicine. What makes the enset system such an intriguing agricultural system is that enset plants are transplanted several times (2 to 4 times in highland Ethiopia depending on the cultural group) during their 3 to 12 year lifecycle.²⁵ In Sidama, enset plants are transplanted once and sometimes twice as will be explained in more detail below. Time to maturity varies widely depending on variety, management, and climate.²⁶ However, most of the variation is due to climatic factors that vary with elevation (time to maturity is positively correlated with elevation). Enset typically must be processed before it can be consumed as food by humans.²⁷ An elaborate process is required to extract the starchy pulp from the pseudostem and corm of the plant. After extraction, an involved fermentation process is completed allowing the

resulting food products to be stored for long periods of time, lasting months to as long as years.²⁸

Figure 3. Diagram of the enset plant. [EnsetDiagram.gif]



From Brandt et al., 1997

STAGES OF ENSET GROWTH IN SIDAMA

The Sidama system of classifying stages of enset growth presented here is specific to Sidama (what Werner and Schoepfle call “native definitions”).²⁹ Each enset-growing ethnic group has a unique system of enset production and classification.³⁰ Like the other enset-growing ethnic groups, the Sidama categorize enset into various stages of growth based on the age and size of each plant (Box 1). Moving from one stage to another occurs either due to transplanting or based on the size of a plant.³¹ Enset plants in Sidama are transplanted only once, or if they are suppressed during the transplanted-sucker stage (awulo), they will be transplanted twice (dukalo). Individual enset plants are referred to by their stage name.³²

Box 1. Stages of enset growth

Unsprouted-corm stage (sima) – The corm typically used for the propagation of enset suckers is ideally taken from a plant from the two-years-after-transplanting stage (simancho), however plants from other stages can be used producing suckers producing suckers with less vigor. The pseudostem of the enset plant is severed from the corm (see Figure 3), the apical meristem is removed, and the corm is buried with manure. “Sima” is the Sidamic term for the corm before the corm has sprouted new enset suckers. This unsprouted corm stage (sima) lasts about 5 to 6 months.

Sprouted-corm stage (funta) – Once the un-sprouted corm (sima) has sprouted suckers, the suckers, still attached to the corm are referred to as in Sidamic as “funta”. No transplanting is done between the un-sprouted stage (sima) and the sprouted stage (funta). The sprouted enset plants (funta) grow, still attached to the corm (sima). The sprouted corm stage (funta) lasts about one year after sprouting. When the suckers (funta) are big enough to go to the next stage, the corm with the suckers (funta) still attached is uprooted and the suckers (funta) are divided from the corm.

Transplanted-sucker stage (awulo/kasho/kora) – Once the suckers (funta) are divided from the sprouted corm they are ready for transplanting. Suckers (funta) grown on the farm, purchased, or received from friends are transplanted to a new area and the plants are then referred to in Sidamic as “awulo,” “kasho”, or “kora”. During the transplanted sucker stage (awulo), the spacing of plants is regular. The transplanted sucker stage (awulo) lasts one year. The transplanted sucker stage (awulo) is usually weeded/manured 4 times.

One-year-after-transplanting stage (katalo) – The main purpose of the one-year-after-transplanting stage (katalo) is to thin out plants suppressed during the transplanted-sucker stage (awulo), allowing the vigorously growing plants to remain in place for further growth. After the thinning process is complete, the remaining plants are referred to in Sidamic as “katalo”. Plants will hereafter remain in their existing location until harvest; no further transplanting will take place. The spacing between plants will hereafter be irregular for the rest of each plant’s life. The one-year-after-transplanting stage (katalo) lasts one year.

Suppressed-enset-plant stage (dukalo) – Plants that are suppressed during the transplanted-sucker stage and are thinned-out at the beginning of the one-year-after-transplanting stage in Sidamic are called “dukalo.” Plants from the suppressed-enset-plant stage (dukalo) can either be used as livestock fodder and/or transplanted to a new area for further growth depending on the relative need for fodder and/or enset growing enset plants. The suppressed-enset-plant stage (dukalo) represents a branch in the primary progression of enset stages (sima, funta, awulo, katalo, simancho, malancho, etancho, bujancho, kalimo). If plants from this stage (dukalo) overcome their stunting, they will reenter the standard progression of enset stages (at the katalo stage) and become

indistinguishable from those plants that traveled through the primary progression of enset stages.

Two-years-after-transplanting stage (simancho) – From the two-years-after-transplanting stage (simancho) onward, the plants receive no further management until harvest. Typically this is the stage used for the propagation of enset suckers (funta). However, earlier stages are currently being used due to a shortage of two-years-after-transplanting stage (simancho). This stage lasts one year.

Three-years-after-transplanting stage (malancho) – Traditionally, harvest for human food begins at this stage. However, harvesting at stages as early as the one-year-after-transplanting stage (katalo) has become common due to the severe reduction in numbers of older plants in most households. This stage lasts one year.

Four-years-after-transplanting stage (etancho) – This stage lasts one year.

Five-years-after-transplanting stage (bujancho) – This stage lasts one year.

Mature-enset stage (kalimo) – This stage is when the enset plant reaches physiological maturity (flowering).

TYPES OF ENSET PROCESSING IN SIDAMA

There are several types of enset processing that are done in Sidama (hassa, shaqisha, howowicho, udee, ulaame). When a household determines that enset processing is necessary, harvesting of enset begins on an as-needed basis in one, linked harvesting/processing operation. Only two types of enset processing will be described here, primary harvest (hassa) and rainy season harvest (ulaame). For enset processing, several women from the community (since many of the operations require several people) are hired by a household and come together to process enset.

Box 2. Types of enset processing

Primary processing (hassa) - This is the main type of enset processing where the bulk of a household's enset products will be produced. Primary processing (hassa) takes place during the dry season (October-February). Enset plants from the three-years-after-transplanting stage (malancho) to the mature-enset stage (etancho, bujancho, kalimo) can be processed during primary processing (hassa). Primary processing (hassa) is conducted in three sizes based on the number of enset plants to be processed. A large primary processing (big hassa), using 200 enset plants or more, is conducted by wealthy households with large enset plantations and provides even the largest households with sufficient food for more than one year. A medium primary processing (medium hassa), approximately 150 enset plants, and a small primary

processing (small hasa), approximately 100 enset plants or less, are conducted by middle and low wealth households. Most households that conduct medium and small primary processings (hasa) typically do not have sufficient food to last until the following year. Farmers interviewed during case studies report that households engaging in large or even medium primary harvests (big and medium hasa) are rare or non-existent do to the low number of enset plants in most households' plantations. Most households engage in small primary processing (small hasa) using even fewer enset plants than have traditionally been used (indicated above).

Rainy season processing (ulaamme) - This is a secondary type of processing taking place during the early part of the rainy season (May-June) whose purpose is to bridge the food gap that exists for households with insufficient food to last the year (households conducting medium and small primary processings). Rainy season processing (ulaamme) is usually used to provide food before maize can be harvested (green or mature). Choice of rainy season harvest processing (ulaamme) is an important indication of food insecurity since it indicates that households are running out of processed enset products before the grain harvest (September-October) and forced to process enset again during the rainy season. Rainy season processing (ulaamme) is less favorable since it has lower labor productivity (1.5 person-days per quintal of processed enset compared to an average of 0.7 for big, medium, and hasa) and is lower yielding (2.1 plants per quintal of processed enset compared to an average of 1.6 for big, medium, and small hasa) than primary processing (hasa) during the dry season based on farmer estimates. Rainy season processing (ulaamme) is a particularly sensitive measure of food security. Since households with small enset plantations typically have no plants larger than the three-years-after-transplanting stage (malancho), they prefer not to conduct rainy season processing with plants from the three-years-after-transplanting stage (malancho) because of the resulting low quality products, but instead consume these plants without processing. Households conducting rainy season processing (ulaamme) can be classified as moderately at-risk, while households opting not to conduct rainy season processing but consume plants unprocessed can be classified as severely at-risk.

STRENGTHS AND WEAKNESSES OF THE ENSET SYSTEM

The traditional enset system of the highland regions of Southern Ethiopia is an indigenous, famine-avoiding agricultural system unique to Ethiopia.³³ The primary strategic importance of enset in food security is that enset helps prevent famine by surviving during droughts when other food crops fail. Although enset is often said to be drought tolerant, it is not drought proof. Enset cannot be grown in semiarid areas. Enset must receive a minimum of about 1100 mm of well distributed rainfall annually for vigorous growth with less than 4-5 contiguous dry months since enset plants must rely on stored soil water to continue growing during dry seasons.³⁴ However, once enset plants are established in areas of sufficient rainfall they are able to tolerate occasional years of very low total rainfall or a short rainy season.³⁵

Other strengths of enset-based livelihood systems include: storage longevity, multiple uses, and high energy productivity per unit area. The ability to store processed enset products for long periods of time with little storage loss provides households with a mechanism to smooth consumption during food shortage periods. Enset plants provide multiple products that serve many different purposes providing the opportunity to flexibly diversify production of different enset by-products (various fiber products, wrapping materials). Kefale and Sandford estimate that enset yields 1.3 to 3.5 times as much food energy per hectare per year as maize grown under similar management conditions.³⁶ For households facing a shortage of land, the higher energy productivity (based on area and time) of enset relative to cereals makes enset an important food security crop.³⁷

However, enset-based livelihood systems do face some fundamental structural weaknesses including low protein content, bacterial wilt, continual harvesting, and the need for manure to maintain vigorous growth. The low protein content of enset products (12 g protein per kg of dry processed enset) compared to cereals (100g protein per kg of dry maize) leaves individuals vulnerable to protein deficiency as they come to rely more heavily on enset during crisis periods.³⁸ Whereas disease in annual crops threaten only the current year's harvest, diseases such as bacterial wilt (*Xanthomonas campestris*) in a perennial crop like enset threatens the harvest for several years into the future.³⁹ The enset system of production is capable of providing households with food security during periodic annual crop food production failures and other crises provided that these crises are separated by several non-crisis years when no enset harvesting takes place and the number of enset plants is allowed to increase. However, if crisis years are spaced too closely and reliance on enset during these crises requires harvesting large numbers of enset plants, the future capability of the enset plantation to provide food security is severely reduced.⁴⁰ Continual heavy harvesting of enset reduces the long term resilience of the enset system to provide food security. This reduction in enset system resilience is increased when the supply of livestock manure for enset fertilization is reduced due to the reduction of household landholdings and communal grazing areas and attendant reduction in livestock numbers that growing population causes.⁴² Farmers interviewed for this study claim that without sufficient manure application, enset growth is not sufficiently vigorous to sustain the high harvesting rates caused by the continual state of crisis that many households now face.

Rapid population growth during the Twentieth Century has dramatically reduced the amount of land available for each household, reducing the number of livestock, and thus manure available for enset.⁴² In addition, the assets of many households have been eroded away as the result of a constant chain of low-level crises in the post-revolution period (1974 to present) due to a combination of factors such as erratic coffee prices, rainfall shortages, endless government restructuring, debilitating and inconsistent macro policy, periodic civil war, and official neglect.⁴³

It is estimated that since prehistoric times the enset system has helped prevent famine in the region and 15 – 20 million people currently depend on enset either as a staple food crop or as a famine crop.⁴⁴ Historically, farmers throughout highland Ethiopia have incrementally intensified the enset system as they have been faced with gradually increasing population density. However, rapid contemporary population growth, and the social, political, cultural and economic changes it brings, now threatens further adaptation and the continued success of this

once food secure agricultural system.⁴⁵ For many in high population density areas, continually shrinking household landholdings are pushing the limits of traditional strategies to provide households with a food secure livelihood. In the face of such rapid contemporary socioeconomic change, it is unclear how these households will be able to adapt their livelihoods to achieve food security.

SIDAMA LIVELIHOOD STRATEGIES

Sidama households have traditionally engaged in various combinations of livelihood activities including: cereals (maize, sorghum, barley, wheat, tef), legumes (beans, peas), root crops (enset, taro, potatoes, sweet potatoes), fruit trees (banana, avocado, citrus, mango), livestock (cows, oxen, sheep, goats, chickens, pack animals, bees), stimulants (coffee, chat), timber (eucalyptus), off-farm work (shopkeeping, civil service, trading, enset processing, laborer, priest) and trades (pottery, black smithing, weaving, basketry, building).⁴⁶ This is a list of the wide range of activities available in Sidama. However, no households would be engaged in all of these activities simultaneously. The combination of activities individuals and households choose depends on household resources, agroecological conditions, and the local and regional socioeconomic context. The overwhelming majority of rural Sidama are engaged in an integrated crop-livestock livelihood system.⁴⁷ One of the keys to success of traditional enset-based livelihood systems is maintaining the proper balance between livestock and access to manure as a source of soil fertility and the size and vitality of enset plantations.⁴⁸ Enset is certainly not the only household livelihood activity, nor is it the most important. However enset has historically played a critical role in household food security. Off-farm work has increased in prominence with the increase in population and the resultant shrinking of household landholdings for crop and livestock activities. Households engaging in trades are more commonly found in urbanizing areas and are often stigmatized for working in trades.

While discussing these livelihood activities, people initially describe a rigid division of labor between men and women. Upon further discussion one discovers a great many exceptions to the general cultural rules governing men's and women's work and even more flexibility exists between adults' and children's work. Men are typically responsible for food crop planting and harvesting, cash crop land preparation and marketing, livestock production and marketing, off-farm work, and various trades. Women are typically responsible for child rearing, food preparation, housekeeping, food and cash crop weeding and processing, food crop marketing, and some trades. However these rough guidelines are obscured by a mass of conditionality. If children are not attending school, boys are expected to assist their father and girls their mother. If boys are in school, they may have no interest in farm work and do everything possible to escape it. Girls in school have little choice about their taste for work and tend to work almost as long as if they were not in school.

According to Degife, the mean household size in Sidama is 9.1 members.⁴⁹ Sidama contains a mix of multi-generational and nuclear households. Nuclear households formed by a son being given a portion of his father's land at marriage have been the ideal in Sidama (8 of 10 case studies conducted for this study). However, multi-generational households (2 of 10 case studies conducted for this study), with married children living with parents until their death, have become more common as household land holdings have decreased. Over 60% of sampled

households have less than 1.0 hectare of land; the mean landholding is 0.84 ha. Approximately 98% of sampled households relied on the division of their parents' farm to obtain land. Degife reports that 6.7% of sampled households have insufficient land to divide a portion off for their children and still be left with a viable amount of land remaining. Fifty-two percent of sampled Sidama households report having 3 to 6 successors to the parents' land and 56.7% of households claim that the dividing of land for married children is the biggest constraint to agricultural production. These statistics suggest that land shortage pressure may be influencing some households to adopt a multi-generational structure to maintain farm-size viability.

Traditionally the Sidama were polygamous, however with the expansion of Protestantism (currently 78% of Sidama households) beginning in the 1930s polygamy has gradually shrunk.⁵⁰ Currently, 26% of households were polygamous, roughly proportional to the percentage of households belonging to religions condoning polygamy (Ethiopian Orthodox, Muslim, and Animist). Serial monogamy is another common practice (6 of 10 case studies conducted for this study). Although death of a spouse occurs (only 1 of 10 case studies conducted for this study), divorce is a more common cause of the serial monogamy phenomenon (5 of 10 case studies conducted for this study). Marital disputes often result in divorce and subsequent remarriage. Young wives often leave when their husband attempts to marry a second wife.

Due to the purposive sampling structure of Degife's Sidama regional food security survey, 10% are FHHs and 90% are male headed households (MHH).⁵¹ Less than 1% of household heads are single and not widowed. The statistics for the number of FHHs and widowed household heads are identical (10%). This implies that almost all FHHs are widowed and that most divorced women get remarried relatively quickly. This interpretation of these figures is supported by the case studies conducted for this study. All of the case studies were male headed at one point, including both households that were female headed in 2000/2001 (both widowers). Most men reported preferring to marry young wives regardless of their own age and tended not to marry widowed women (0 of 8 MHHs married widowed women, 2 of 2 widowed FHHs remain unmarried at the time of the interviews and consider themselves very unlikely to remarry). Until the most recent regime, women had no legal property rights (officially there is no private land ownership, all land is owned by the state and long term leases are granted). Despite the recent national law that gave women the right to lease land, women in rural areas throughout most of Ethiopia are rarely able to gain access to land independent of a male relative.

However, FHHs tend not to remain female headed very long. After the death of a male household head, the search for a successor begins immediately. Sons that are interested in farming will become the new household head when they are old enough to marry, until that time the household remains female headed. In Sidama, FHHs are ideally only a temporary state. Why? Without a male household head, a female household head is particularly vulnerable to land claims that can potentially be made by her husband's male relatives.⁵² Due to widespread land shortage, there is intense pressure for Sidama households to name a male successor. Therefore, FHHs, especially those with prime land, must often struggle with the delicate question of identifying a successor and must defend their children from rival male relatives.⁵³ Those FHHs that remain female headed for an extended amount of time are likely to be virtually landless (see case study below). Sidama property rights regimes and the cultural

norms governing FHH formation and dissolution conditions FHHs choice of livelihood strategy as shown in the case study below.

THE SIDAMA ENSET PRODUCTION AND PROCESSING SCRIPTS

The enset production and processing script presented here developed over centuries and has remained relatively unchanged despite the dramatic socioeconomic changes experienced during the Twentieth Century. The Sidama today produce and process enset much the same as they have for centuries. The only notable exception is the option of using inorganic fertilizer that emerged with increasing coffee extension that occurred in the later decades of the Twentieth Century. However, inorganic fertilizer is a very recent occurrence and its routine use has not been widely integrated by most farmers into the enset production script (Box 3). Although the inorganic fertilizer decisions are included in this script, most farmers quickly rule out its use, primarily due to cost and other constraints discussed briefly below.

During the case study interviews, when people are asked about who does what in Sidama, everyone claims that men are responsible for enset production and women are responsible for processing. However, this does not mean that only men are involved in production and only women are involved on processing. Upon further observation and questioning it becomes clear that both men and women are both involved in a range of activities ideally deemed appropriate only for the other sex. This crossing of gender lines is especially marked in FHHs and in their case little of what follows in terms of division of labor applies. These gender dynamics make more sense when traditional Sidama men and women's production roles are further examined.

Sidama believe that men's role is to produce enset and that women's role is to process enset. Men and women ideally have separate production domains, where one may enter the other's domain, but strictly on the other's terms. For example, although men may participate in specific aspects of enset processing (digging pits, mixing, squeezing, transporting enset products around processing areas), women are clearly in charge of the whole procedure, doing the skilled operations, and making all decisions with men largely following orders (Boxes 4 and 6). The same is true of enset production, with women providing much of the manuring and weeding labor, with men in charge of the operation, making most of the critical decisions, and doing the skilled operations (Boxes 3 and 5). There are two possible exceptions to this concept of gender domains that seem to prove the rule, one for production and one for processing (these decisions will be marked with an asterisk in the scripts for distinction). First, although men are responsible for enset production, men and women (often heatedly) discuss what mix of enset varieties ("clones" since enset is vegetatively propagated) will be propagated or bought based on the different qualities valued by men and women.⁵⁴ The second exception is that men and women debate which clones and how many enset plants from each stage will be harvested for processing due to the different objectives of men and women. One explanation for these domain exceptions (women "meddling" in enset production and men "meddling" in enset processing) is that these are two decisions where men and women's domains overlap. The production decision about what clones to propagate and/or buy and plant can cause conflict between men and women because different enset clones have different uses.⁵⁵ Another traditional domain of Sidama women (as elsewhere) is providing food for the household, and another traditional domain of Sidama men is livestock production. Since enset can be used both for human food

and animal fodder (as well as for other purposes, adding to its politicization), men and women often compete for enset products to meet the various needs within their domains. This competition for enset resources precipitates a complex process of negotiation between men and women within the household to fill their roles. As one might expect, this process plays out in a range of ways for different households and is beyond the scope of this paper.

Box 3. Enset production and processing script.

October-November, year 1 – Sub-script: Prepare land for propagation (sima).

Female labor: 1 hour/corm

Male labor (hired or household): 2 hour/corm

Four steps are required for bed preparation. First a small amount of land (about 4 sq. m per corm) is selected, usually near the house. Second, manure is applied prior to tilling. Transportation of manure from the house to the enset field has traditionally been the sole responsibility of women and girls. This is onerous work and everyone complains about it. One basket holding about 4 to 6 kg of manure (gimbola) is placed between the spots where the corms will be planted. The third step is done with a chest-height, double-poled hoe (wenencho) used to turn the grass under. The fourth step is done with a short handled hoe with a wide blade (jamba, safuya). The hoe is used to cut-up the turned clods of soil and mix the manure into the soil. Men typically do tilling.

November-December, year 1 – Sub-script: Propagate suckers (sima).

Female labor: none

Male labor: 1 hour/2 corms

There are three steps in propagation. First, typically corms from the two-years-after-transplanting stage (simancho) are used for propagation, however other stages can be used. The enset plant is prepared for propagation by removing the pseudostem of the plant just above the corm and the pseudostem is processed along with a sufficient quantity of other plants (for processing details, see Box 4). Second, the central shoot of the corm is cut out to induce the budding of sprouts from auxiliary buds. Third, holes are dug at 1.0 m spacing and the corm is buried.

February-March, year 2 – Sub-script: Weed unsprouted corm (sima).

Female labor: none

Male labor: 1 hour/2 corms

The unsprouted corm stage (sima) is weeded once approximately two months after planting at the end of the January-February rains (belg). No manuring is done at this weeding since manure was applied during land preparation. Men typically do weeding. There are two steps to this weeding. First, large weeds are pulled-up by hand, the dirt is knocked-off, and the weeds are left as mulch. Second, small weeds are simply hoed under using a short handled hoe with a single pointed head (helako or tike).

September-October, year 2 – Sub-script: Weed sprouted corm (funta).

Female labor: none

Male labor: 1 hour/2 corms

The sprouted corm (funta) is weeded once, typically after the June-September rains (meher). No manuring is typically done at this weeding since manure was applied during land preparation. The weeding process is exactly the same as the weeding of the unsprouted corm.

January-February, year 3 – Sub-script: Prepare land for sucker transplanting (awulo).

Female labor: 0.5 hours/2 sq. m plot

Male labor: 2 hours/2 sq. m plot

Four steps are required for bed preparation. First, a plot (about 2 sq. m) must be selected to plant the approximately 100 suckers produced from two average corms. Second, women prior to tilling apply manure. Typically, 1, 4 to 6 kg baskets of manure (gimbola) are applied to a 2 sq. m plot at this stage. The third step is done with a chest-height, double-poled hoe (wenencho) used to turn the grass under. The fourth step is done with a short handled hoe with a wide blade (jamba, safuya). The hoe is used to cut-up the turned clods of soil and mix the manure into the soil. Men typically do tilling.

March-April, year 3 – Sub-script: Transplant suckers (awulo).

Female labor: none

Male labor: 1 hour/2 sq. m plot

There are three steps to transplanting suckers. First, the sprouted corm is uprooted. Second, the suckers (funta) are divided from the corm. Third, suckers (funta) are transplanted at about 15-20 cm diagonal spacing (about 50 suckers/sq. m). Men plant suckers (funta) using a chest-height, single-poled hoe (wenencho). Once the suckers (funta) are planted they are referred to in Sidamic as “awulo”. Small, weak, or inferior suckers (funta) can be planted in groups of 2 or 3 plants in the same hole at the same spacing along with the vigorous suckers (funta). These stunted suckers planted in groups of 2 or 3 in the same hole once planted are referred to in Sidamic as “mugicho”.

May-June, year 3 – Sub-script: Do first transplanted-sucker (awulo) weeding/manuring.

Female labor: 0.5 hour/2 sq. m plot

Male labor: 1 hour/2 sq. m plot

The first weeding (karkara) is typically done about two or three months after sucker (awulo) transplanting. There are three steps to this weeding. First, manure is placed between the plants by women. Approximately 20, 4 to 6 kg baskets of manure (gimbola) are typically applied to an area of 50 sq m. Second, manure is tilled-in by men using a short handled hoe with a single pointed head (helako or tike) during the weeding process. Large weeds are pulled-up by hand, the dirt is knocked-off, and the weeds are left as mulch. Small weeds are simply hoed under

along with the manure. Third, for the plants that are growing vigorously, men turn down the leaves to prevent their suppression of the surrounding plants. Turning down the leaves at this time helps to equalize the growth across the cohort of plants. The turning down of leaves is done by grasping the leaf midrib near the base and rapidly snapping the midrib in a downward motion. The leaf is not necessarily totally removed. It can be left loosely attached to the plant, left as a mulch at the base of the plant, or fed to animals.

July-August, year 3 – Sub-script: Do second transplanted-sucker (awulo) weeding/manuring.

Female labor: 0.5 hour/2 sq. m plot

Male labor: 1 hour/2 sq. m plot

This weeding/manuring is done exactly the same as the first weeding/manuring operation except that the rate of manure applied is slightly reduced and leaves are managed slightly differently. Approximately 15, 4 to 6 kg baskets of manure (gimbola) are typically applied to 50 sq. m. During the second weeding, the leaves of all plants are turned down. Turning down the leaves at this time allows water to infiltrate better during the rainy season and helps to equalize the growth across the cohort of plants. Any plants that have died are removed and suppressed enset plants from the same cohort are transplanted into their place. The stunted suckers planted in groups of 2 or 3 (mugicho) are typically used to replace dead suckers.

September-October, year 3 – Sub-script: Do third transplanted-sucker (awulo) weeding/manuring.

Female labor: 0.5 hour/2 sq. m plot

Male labor: 1 hour/2 sq. m plot

Box 4. Sub-script: Do small primary processing (small hasa).

Starting October-February – Sub-script: Process pseudostem and corm.

Female labor (hired or household): 30 person days

Male labor (hired or household): 4 person days/

The purpose of this stage is to uproot the enset plants from the enset field and transport the plants to the processing areas and extract the pulp from the pseudostem and pulverize the corm. Women conduct the processing portion of this stage. Men assist women in the uprooting and transport of plants to the processing areas due to the large number of plants required for primary processing (hasa). The plants must be dug out of the ground and the leaves are removed using a knife (konchora). The following numbers of each stage are uprooted and transported to the processing areas. Ten, three-years-after-transplanting stage plants (malancho) are harvested per day for the first five days. Twenty-five, four-years-after-transplanting stage plants (etancho) and 25, five-years-after-transplanting stage plants (bujancho) if available. Enset plants are continually harvested and partially processed over approximately a 15 day period. Two women typically work together to process the enset

plants. Each day as the plants are harvested and brought to the processing areas, the corms of the plants are processed in one area (corm processing area, CPA) and the pseudostems are processed in another area (pseudostem processing area, PSPA). In the PSPA, the starchy pulp (abicho) is extracted using a bamboo (sisicho) or metal scrapper to scrape the pseudostem while it lays on a slanting board (meeta) that is supported by a 'y' shaped vertical post (dawe). A pit is dug and lined with enset leaves under the slanting board (meeta) where the extracted pulp is placed. High quality fiber for making ropes, mats, etc. can be extracted from the inner portions of the pseudostem, while the tough outer portions of the pseudostem are saved and dried (shigido) for use as wrapping, tying, and for building material. At the CPA the outer soil-covered portion of the corm is pared-off and discarded. The corm is pulverized using a serrated tool made of cattle bone (keho). The pulverized corm (dassa) is placed into a two pit system lined with enset leaves that allows the liquid from pulp stored in an upper pit to drain into a lower pit when it is squeezed and mixed through treading with the feet. Each evening the pulp from the PSPA extracted that day (abicho) is brought to the CPA and mixed with the pulverized corm (dassa) in the higher pit. The combined mixture of processed pseudostem (abicho) and processed corm (dassa) pulp is then referred to as "abicho" (abicho + dassa = abicho). The starch-rich liquid that drains into the lower pit is allowed settle overnight, and in the morning the water is drawn off of the top and a fine, high quality starch is left behind (bulla). This routine continues until the appropriate number of enset plants have been harvested, requiring two women about 15 full days to complete.

5 days after pseudostem and corm processing started – Sub-script: Prepare fermentation starter (gamancho).

Female labor (hired or household): 0.5 person days

Male labor (hired or household): none

The purpose of this stage is to prepare a fermentation starter (gamancho) made from fermented sections of mature enset corms that will be used to help inoculate the processed pseudostem and corm to allow it to properly ferment to maturity. Women solely conduct this stage of processing. This stage runs concurrently with pseudostem and corm processing and is started about 20 days after harvesting and processing has begun. This stage takes about 8 to 10 days to complete and is therefore started about 10 days before the beginning of the next step must begin. Only corms from four-years-after-transplanting stage plants (etancho) and five-years-after-transplanting stage plants (bujancho) work properly for making the fermentation starter (gamancho). A section of the corm is cut off, rubbed with a piece of dried enset pseudostem (shigido) or other local plant (hecho, maraca, etc.). The corm is then tightly wrapped with pieces of dried enset pseudostem (shigido) to make an airtight wrapping (first sala) and left for 5 days. On the fifth day the wrapping is removed in the morning and allowed to air until evening. At this stage the corm is checked for proper ripening. The corm is fed to animals if not ripening properly and is not used for enset

processing. On the evening of the fifth day the ripening corm is re-wrapped (second sala) and allowed to continue ripening for another 3 to 5 days.

After pseudostem and corm processing completed – Sub-script: Add fermentation starter (gamancho) to processed pseudostem and corm (abicho).

Female labor (hired or household): 1 person day

Male labor (hired or household): 1 person day

The purpose of this stage is to thoroughly and systematically mix the fermentation starter (gamancho) with the processed pseudostem and corm to start the fermentation process. The mixing can be completed in one day if five people are working and then requires about 5 days of maturation time before the next stage. The maturation of the fermentation starter (gamancho) is timed to coincide with the end of pseudostem and corm processing. Both men and women from the household or the community can participate in this stage of processing. To begin the mixing of the pseudostem and corm pulp (*abicho*), the pulp is transferred from the CPA to the PSPA. There the fermented corm (gamancho) is unwrapped, pulverized, and systematically mixed with the pseudostem and corm pulp (*abicho*) by treading with the feet. After the mixing of pseudostem and corm pulp (*abicho*) with the fermented corm (gamancho) is complete, the pulp is then moved from the PSPA back to the relined CPA pit for 5 days of maturation. The pulp is now referred to in Sidamic as “wassa”.

5 days after adding fermentation starter – Sub-script: Do first mixing.

Female labor (hired or household): 1 person day

Male labor (hired or household): 1 person day

The purpose of the first mixing is to thoroughly mix the processed enset pulp (wassa) and test the adequacy of the fermentation starter (gamancho). Both men and women from the household or the community can participate in this stage of processing. The mixing can be completed in one day if five people are working and then requires about 5 days of maturation time before the next stage. The mixing is done at the PSPA and is done by treading with the feet. The liquid from the pulp is retained during this mixing to assist in getting the fermentation process started.

5 days after first mixing – Sub-script: Do second mixing.

Female labor (hired or household): 1 person day

Male labor (hired or household): 1 person day

The purpose of this mixing is to thoroughly mix the processed enset pulp (wassa). Both men

and women from the household or the community can participate in this stage of processing. The mixing can be completed in one day if five people are working and then requires about 5 days of maturation time before the next stage. The mixing is done at the PSPA and is done by treading with the feet. The liquid from the pulp is retained during this mixing to assist in getting the fermentation process started.

5 days after second mixing – Sub-script: Do third mixing.

Female labor (hired or household): 1 person day	Male labor (hired or household): 1 person day
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The purpose of this mixing is to thoroughly mix the processed enset pulp (wassa) and to remove the liquid from the processed enset pulp. Both men and women from the household or the community can participate in this stage of processing. The mixing can be completed in one day if three people are working and then requires about 5 days of maturation time before the next stage. The processed enset pulp is transported from the PSPA to the CPA and the liquid is squeezed out of the pulp through treading with the feet using the two-pit system. The liquid is retained for use as a fermentation starter in an auxiliary type of processing (shaqisha).⁵⁶

5 days after third mixing – Sub-script: Do fourth mixing.

Female labor (hired or household): 2 person day	Male labor (hired or household): 1 person day
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The purpose of this mixing is to thoroughly mix the processed enset pulp (wassa) and to remove the last of the liquid from the processed enset pulp. Proceeds exactly the same as the third mixing except that there is no need to transport the processed enset pulp (wassa) to the CPA.

5 days after fourth mixing – Sub-script: Place in final pit.

Female labor (hired or household): 1 person day	Male labor (hired or household): 1 person day
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The purpose of this final mixing is to squeeze the last of the liquid from the processed enset pulp (wassa) and place it into the final pit for long-term storage. Both men and women from the household or the community can participate in this stage of processing. The final squeezing and transfer can be completed in one day if five people are working. The squeezing is done by hand at the CPA. A pit, usually dug inside the house for theft prevention, is lined with enset leaves and the squeezed pulp is compacted in the pit by treading with the feet. An airtight seal is created over the pit using enset leaves and dried

pseudostems (shigido) and the pit is covered with soil.

HOW THE SCRIPT WORKS

Scripts guide the user through the steps necessary to complete a job. Scripts are followed step by step, from top to bottom. The user moves (usually preconsciously) down through the script following the script's directions. Scripts can be represented hierarchically to hide more detailed information in sub-scripts. These scripts can be written to include as little or as much detail as necessary, depending on their intended purpose.

Most people use the same basic script. However, experts' scripts will contain more decisions, more complex decisions, and more operational details than inexperienced people's scripts. Experts' sub-scripts are likely to be more precise, containing more exact timing of events and more explicit instructions regarding the execution of each operation. Sub-scripts of less expert enset farmers will likely be less precise. Since scripts are taught and learned, some people will naturally become more expert than others reflecting both their teachers' (typically parents) knowledge and their own intellectual ability and interest. The script presented here is a basic script that most, Sidama enset farmers would agree represents the essential information necessary to grow and process enset. Experts will think it lacks sufficient detail, while individuals with less than average enset growing and processing expertise will notice detail that they do not use. Since men are traditionally responsible for enset production, they tend to have more detailed knowledge of the production script than women and since women are traditionally responsible for processing enset, they tend to have more detailed knowledge of the processing script than men. However, since gender roles are not rigid, there are some experts, both male and female, that have extremely detailed knowledge of sections of the script they are not normally expected to know. FHHs provide an example of women forced by necessity to obtain more detailed production script knowledge, an area they are not normally expected to have expertise.⁵⁷

Schank and Abelson point out that scripts are not able to handle novel situations, and in such novel cases planning is necessary.⁵⁸ As plans become routinized over time they are eventually transformed into new scripts. Enset farming experts often discover better ways of doing things by generating plans and through the routinization of these plans they modify the scripts they use to incorporate these innovations. For these experts, scripts are not preconscious as they likely are for most. Experts' intense interest and planning make them aware of the various steps and embedded decisions. Expert planning and script modification exists along a continuum from incremental refinement of the existing script (adding inorganic fertilizer with manure, processing tools creating less waste) to fundamental reorganization of the script (adoption of more intensive fodder production techniques).

Although most people use the same script, most people don't reach the same outcome. All enset farmers using the same script do not reach the same outcome because they do not follow the same path through the one script. For example a poor FHH with not enough land for enset may choose not to follow the production section of the script.⁵⁹ She would choose not to produce enset (Box 3) and would therefore skip the steps in the production section of the script. However, just because a household produces no enset does not mean that they exit the script

entirely. FHHs often choose to process enset for other wealthier households. A wealthier MHH may choose to produce enset in such large quantities that the female labor within the household is insufficient to process all of the enset produced. Therefore, this MHH would choose to process some or all of its enset using outside labor (Box 4). The wealthier household chooses to process enset using hired labor and the FHH would continue following the processing steps (Box 4).

GENDER DIVISION OF ENSET LABOR

The labor time estimates in Boxes 3 and 4 are based on the total amount of labor necessary to produce and process 100 enset plants from propagation through processing.⁶⁰ The script format allows a cohort of plants to be followed from the beginning of the process until the end, documenting the male and female labor required along the way. These gender disaggregated labor estimates are summarized in Tables 2-4. One of the most striking set of numbers from this table is the remarkably low amount of time required for production and the large amount of time required for processing. Throughout the life of each plant, only about 11 minutes of labor is required on average for production (18 production hours x 60 minutes)/100 plants). In contrast, each plant requires on average over 3.6 hours of processing labor (364 processing hours/100 plants). Since women are largely responsible for processing enset (women provide 82.4% of processing labor), women provide about 80% of the total labor required for enset production and processing, whereas men provide only about 20% of the total labor requirement (Table 4).

Table 2. Gender division of enset production labor.

Operation	Women		Men		Total	
	hrs	%	hrs	%	Hrs	%
Prepare land for propagation	1.0	5.6	2.0	11.1	3.0	16.6
Propagate suckers	–		1.0	5.6	1.0	5.6
Weed unsprouted corm	–		1.0	5.6	1.0	5.6
Weed sprouted corm	–		1.0	5.6	1.0	5.6
Prepare land for sucker transplanting	0.5	2.8	2.0	11.1	2.5	13.9
Transplant suckers	–		1.0	5.6	1.0	5.6
Do first transplanted-sucker weeding/manuring	0.5	2.8	1.0	5.6	1.5	8.3

Do second transplanted-sucker weeding/manuring	0.5	2.8	1.0	5.6	1.5	8.3
Do third transplanted-sucker weeding/manuring	0.5	2.8	1.0	5.6	1.5	8.3
Do fourth transplanted-sucker weeding/manuring	0.5	2.8	1.0	5.6	1.5	8.3
Do thinning/transplanting	–		1.0	5.6	1.0	5.6
Do after-thinning weeding/manuring	0.5	2.8	1.0	5.6	1.5	8.3
Total	4.0	22.2	14.0	77.8	18.0	100.0

Table 3. Gender division of enset processing labor

Operation	Women		Men		Total	
	hrs	%	hrs	%	Hrs	%
Process pseudostem and corm	240	65.9	32	8.8	272	74.7
Prepare fermentation starter	4	1.1	–		4	1.1
Add fermentation starter to processed pseudostem and corm	8	2.2	8	2.2	16	4.4
Do first mixing	8	2.2	8	2.2	16	4.4
Do second mixing	8	2.2	8	2.2	16	4.4
Do third mixing	8	2.2	–		8	2.2
Do fourth mixing	16	4.4	–		16	4.4
Place in final pit	8	2.2	8	2.2	16	4.4
Total	300	82.4	64	17.6	364	100.0

Table 4. Gender division of enset production and processing labor

Operation	Women		Men		Total	
	hrs	%	hrs	%	Hrs	%

Enset production	4	1.1	14	3.7	18	4.7
Enset processing	300	78.5	64	16.7	364	95.3
Total	304	79.6	78	20.4	382	100.0

THE ENSET SCRIPT'S FOOD SECURITY PERFORMANCE

At the national level, Ethiopia has undergone a tremendous transformation during the post-revolution (1974) period. The following statistics from the Ethiopian Economic Association tell part of the story. Although Ethiopia is already ranked as one of the poorest countries in the world by almost any measure, many of the critical human development indicators appear to be getting worse, not better between the time of the first census in 1984 and the second census in 1994.⁶¹ The population growth rate for Ethiopia in 2000 is estimated to be between 2.45 to 3.39% per annum.⁶² Ethiopia already has the third largest population in Africa (currently approximately 60 million) and with 50% of the current population under the age of 17, these high rates of population growth can be expected to continue well into the future. National per capita food production has fallen consistently from 240.2 kg in 1960 to 141.7 kg in 1990.⁶³ Although the national total fertility rate (TFR) has decreased from 7.52 births per woman in 1984, to 6.74 in 1994, life expectancy (LE) appears to have dropped from 52.0 years in 1984 to 50.7 years in 1994. The national infant mortality rate (IMR) increased from 110 per 1000 live births in 1984 to 116 in 1994. The national under-5-mortality-rate (U5MR) increased from 166 deaths per 1000 to 171 in 1994. The statistics for the Southern Region (when available) are all worse than the national averages (TFR 7.16, LE 48.6, IMR 128).⁶⁴

At the regional and household level, evidence can be found from Degife's Sidama food security study that helps to explain elements of this erosive process seen from the national level.⁶⁵ Mean household landholding size in Sidama is 0.84 hectares. With a mean household size of 9.1 persons, the ratio of cultivated land per person is very low (~0.09 ha/person). Consequently, 81.0% of sampled households report that their household's farmland is not sufficient for their household, while only 19.0% of households report having enough land. Eighty-seven percent of sampled households report that it is not possible to get more farmland, while only 12.9% of households report the possibility for getting more land.

The impact of this land shortage on food security is clear. Seventy-four percent of households report that their farm is not sufficient for food production, while only 25.1% report that their land is sufficient. Seventy-four percent of households report having insufficient food until the next harvest, while only 24.7% report having enough. Eighty-three percent of households reporting having enough cultivated area for food production also report having sufficient food until the next harvest, while 91.2% of households reporting not enough cultivated land for food production also report having insufficient food until the next harvest (Pearson chi-square 150.29, p value < 0.0005). This strong correlation implies that household food security is largely dependent on a household's land assets and consequently its ability to produce its own food. This finding is not surprising given the agrarian structure of the region.

Seventy-two percent of sampled households report that the grazing areas on their farm is decreasing, or not changing (17.0%), while none reported grazing land to be increasing. What is

causing this reduction of on-farm grazing land? When respondents were asked to explain the reason for this decline in on-farm grazing land, 52.8% reported that the grazing land was needed for increased crop production, 44.0% reported a combination of expanding crop production and tree planting, and 2.9% needed more land for their house. To address the food insufficiency that many households are currently facing, it appears that many households are increasing the proportion of cultivated land planted with food crops at the expense of on-farm grazing land. Given farmers' reports of the decrease in the size of communal grazing areas and of an increase in stocking rates over time, this decline in on-farm grazing land has very detrimental effects on households' ability to maintain livestock.

As a result of the reduction of grazing resources, 54.9% of households report that fodder shortage is currently the biggest obstacle to keeping livestock. Seventy-nine percent of households report that the most severe fodder shortage occurs in the dry season, yet 88.4% of households report having no dry season fodder storage facilities. Although farmers are facing severe fodder shortages during the dry season, few farmers report adoption of more intensive methods of fodder production or storage.

Several important points can be made about the coping measures adopted by food insecure households. The first point to notice is that the most common response to food shortage is the selling of livestock (28% of households). Respondents interviewed for the case studies report that farmers have been surviving numerous crises partly through the sale of livestock and that livestock numbers have now reached a critical level. Table 6 provides survey data showing that for all livestock types the majority of households surveyed report decreasing livestock numbers over the past five years. Since 75.0% of households consider livestock production to be an important priority for future food security, repeated destocking episodes, although an effective short-term survival and coping strategies, cannot be considered a viable long-term strategy because it never allows livestock numbers to recover.

Table 5. Food insecurity coping and survival strategies

If the household does not have enough food until the next harvest, then how does the household manage to feed itself?	% of households
Sell livestock	28.5
Reduce the quantity and quality of food	19.0
Sell labor	15.9
Process immature enset	14.3
Petty trade	7.5
Sell immature coffee on the tree	1.9

Table 6. Changes in livestock over the past 5 years

Livestock type	% of households having each livestock type	% of households with increasing livestock during the last 5 years	% of households with decreasing livestock during the last 5 years	% of households with unchanged livestock during the last 5 years
Cows	93.3	27.0	63.8	4.4
Oxen	37.0	8.0	68.2	4.8
Sheep	29.5	21.5	57.0	21.5
Goats	31.9	17.4	64.0	18.6
Pack animals	33.3	10.0	48.9	41.1
Chickens	49.3	34.6	56.4	9.0
Beehives	24.0	21.5	48.2	29.3

During the interviews for the case studies, farmers emphasized that the selling of assets such as livestock have limited the amount of manure that farmers can apply to enset fields to maintain soil fertility. The above script has no built-in contingencies for dealing with a lack of manure. Notice that the enset production script (Box 3) only provides specifics for the application of manure and nowhere even mentions how one should apply inorganic fertilizers. The enset production script contains no alternative soil fertility amendment options. The enset production script was constructed under the assumption that sufficient manure would be available to ensure vigorous growth. Most farmers tend to follow the script without modification. If they have less manure than the amount the script calls for, then they simply apply what they have. The amount of manure that the enset script specifies should be applied to enset is a function of the amount of manure necessary to obtain vigorous enset growth, not a function of manure supply. Farmers report that they are now forced to apply well below the amounts of manure necessary for vigorous enset growth due to the decline of livestock holdings. The application of inorganic fertilizers as an alternative to manure is only being tentatively tested by a few farmers as a soil fertility amendment replacement for farmers with declining access to manure. Farmers say that inorganic fertilizer can be used for enset, but that it is not as preferred as manure. They report that the land becomes “addicted” to fertilizer. They point out that once you start applying chemical fertilizer, you must continue or yields will drop quickly after stopping. The commonality of the ‘addicted to fertilizer’ response throughout Ethiopia is likely due to the biophysical process of declining soil organic matter resulting from the use of inorganic fertilizer versus manure rather than this information being culturally encoded and passed along via a script. Farmers claim that manure is preferred because it requires no cash outlay and the soil fertility is much longer-lived than with the application of inorganic fertilizer. However, farmers say that inorganic fertilizer is easy to apply and that they are familiar with its use because of experience gained applying it to coffee. However, farmers complain about the high cost of inorganic fertilizer. They point out that unless their coffee yields well and prices for coffee are good, they have no extra income to purchase fertilizer.

Farmers emphasize that the inorganic fertilizer price has only continued to rise and with recent devaluations that it is now almost totally out of reach even for wealthy households.

In the past livestock were abundant and enset groves received the bulk of the manure that supported the vigorous growth necessary to maintain the resilience of the groves to handle periodic heavy harvesting during grain crop failures. Now farmers are forced to plant enset without the addition of sufficient manure or none at all, resulting in stunted growth and lower yields (plants continue to age, but gain little weight). This author is unaware of any region-wide soil fertility studies that exist to empirically quantify the change in soil fertility status of enset fields. The only data that is available on soil fertility status is farmer testimony that enset yields are declining due to the lack of manure and the inferences that can be drawn from nutrient cycling studies with the knowledge that manure additions have declined.

In the past, the enset script was built around reliable cash income from coffee allowing many older farmers to hire labor for land preparation and weeding that would otherwise be difficult to complete. Increasingly erratic and declining coffee income means these older farmers often are unable to complete critical enset production activities, lowering yields and leaving dangerous gaps in the age structure of enset groves. Due to the low numbers of enset plants of harvestable age, most farmers in Sidama harvest only small primary processing (small hassa) to last the entire year, as mentioned above. The logic of the enset system, represented by the above scripts, never 'intended' for an entire household to survive for a whole year solely on one small primary processing (small hassa). Farmers emphasize that small primary processing (small hassa) were intended to augment other types of processing. Box 2 explains the interrelationship between the two types of processing types described in this paper. Medium and small primary processings (medium and small hassa) require a rainy season processing (ulaamme) to help bridge the food gap between when food runs out from the medium and small primary processings. However, farmers interviewed for this study report that many households have too few enset plants to conduct this second rainy season processing. These along with other examples provide some evidence that the traditional enset production and processing script is not operating according to its historic logic.

During the case study interviews, farmers claim that this series of crises have forced many Sidama enset-growing households to repeatedly harvest large amounts of enset to survive these crises. Degife's regional survey data shows that 57.8% of households report relying on enset to feed their animals during the dry season and 25.2% rely on a combination of enset and crop residues.⁶⁶ Fourteen percent of households report processing immature enset if the household does not have enough food until the next harvest (Table 2). Although these are important food security enhancing survival and coping strategies of enset agriculture, when used repeatedly they tax the resilience of the enset system. Coupled with declining soil fertility due to shrinking land size and the loss of livestock and access to manure causing enset plants grow less vigorously, farmers report that groves are now at critical levels. These periodic shocks have destroyed the ideal pyramidal age structure of enset plantations (many small young plants, a medium number of medium sized-medium aged plants, and few large old plants) through the continued harvesting of most large and medium sized plants.⁶⁷ Removal of the upper and medium layer of the pyramid has eliminated the resilience of the groves for protecting households against food security shocks in the short (1-4 years) and medium term (5-10 years).

Sidama households have been living off of the food security of the future to survive the crises of the past. Many household enset groves are at dangerously low levels. Their enset groves will now provide them with no cushion for future shocks. The groves need time to recover, allowing the young plants time to mature, while continuing to propagate a steady stream of young plants for the future. Finding new methods of soil fertility improvement that farmers can afford are a critical aspect in this recovery process.

Based on discussions with farmers, the script presented here is no longer providing households with food security as it once did. It is proposed that the failure of the enset script to provide households with food security today is because it is being applied outside its historical parameters. The script that once provided food security can no longer do so in its current form. The production rules of this script are valid for a former set of socioeconomic conditions. The socioeconomic conditions have changed, but the production rules (script) have not kept pace. If the food security capability of the enset system is to be restored, adaptation of the script is necessary to address the decline in soil fertility caused by the gradual loss of livestock from the system.

CASE STUDY

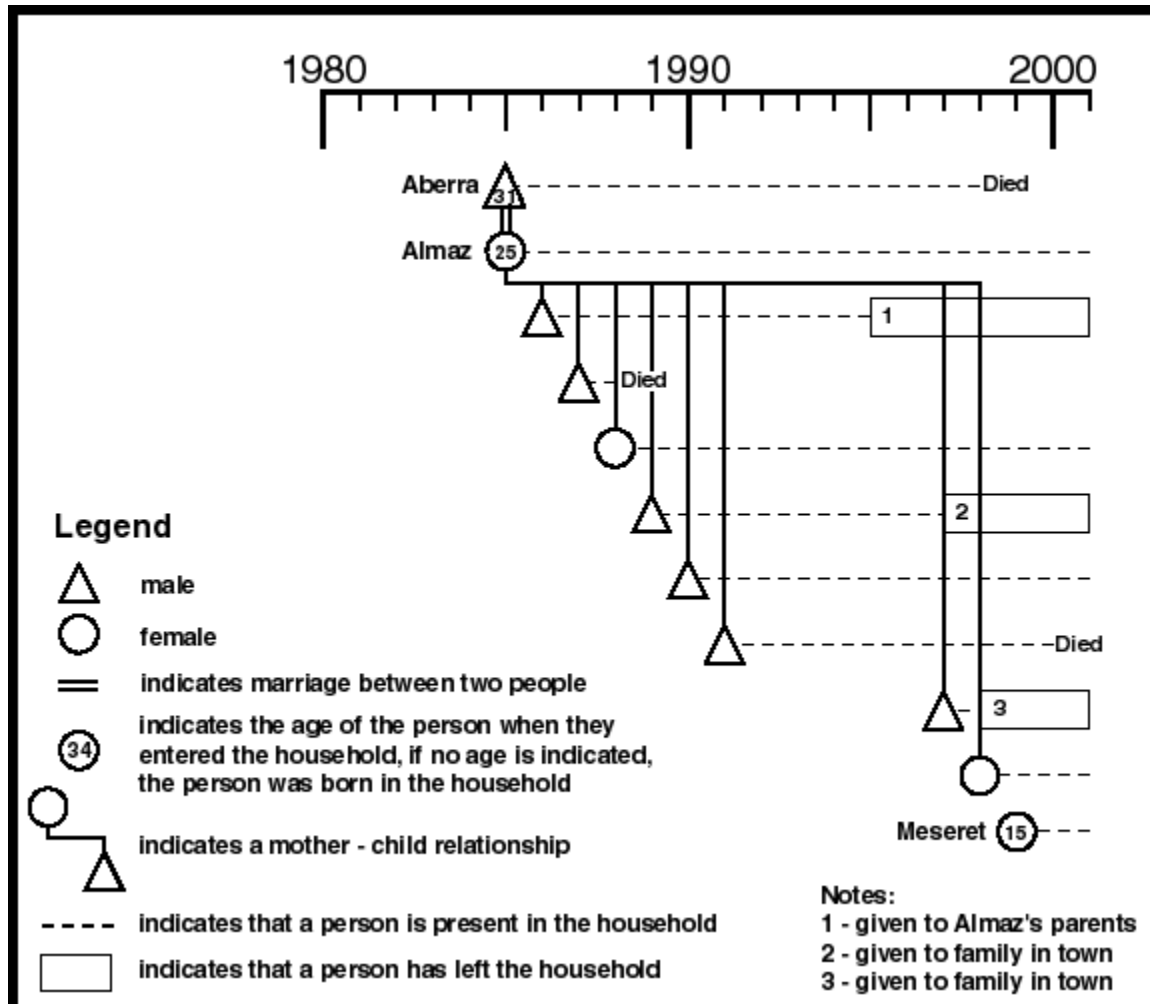
Script failure has a human face. The enset script directly links wealthier MHHs to generally poorer FHHs at the processing step of the script by wealthier households hiring often poor women within the community to process enset. Almaz, described in the case study below (Box 5), depends on a traditional Sidama patron-client relationship where she processes enset for her more wealthy neighbors, receiving enset in payment. The enset script's current failure affects most households that use the script, but this failure's effect on the poorest, at-risk households can be devastating. Although Almaz's household was not in a food secure position at the beginning of the narrative when her husband was alive, notice the shift in livelihood strategies from the categories of adaptive to coping to survival. Almaz's coping and survival strategies shift first from non-erosive disaccumulation to dangerous levels of erosive disaccumulation.

Box 5. Almaz.

Almaz was 25 when she and her husband Aberra were married in 1985. In the six years following their marriage, she had six children, five boys and one girl. They lost their second child, a boy, a year after his birth. Aberra tilled their small plot (0.12 ha), worked for neighbors, and found odd jobs in the nearby town. Almaz took care of their children, tended their two cows, and processed enset for several neighbors. During the first seven years of their marriage they never seemed to have anything extra, but they always had enough. However, Aberra started with a cough that never seemed to go away. In the beginning there were some days that he couldn't work, but as the cough grew worse, neighbors began to realize that they couldn't rely on him to plow or weed their plots as he once faithfully did. They had to sell one and finally their last cow to pay for doctors, medicine, and food. Almaz had always relied on processing enset for her neighbors to feed her family, but her neighbors called her less, complaining about how their enset fields were gradually shrinking. Their own enset field shrunk quickly during these

difficult times. They sent their oldest son to live temporarily with Almaz's parents and another son to live with a family in town until things got better. After taking the medicine the doctor had given him, Aberra's cough eventually subsided and he slowly began to gain back his strength. After five years of sickness, during which time Almaz gave birth to no new children, she then had two more children, a boy and a girl about a year apart. Aberra worked long hours trying to earn enough money to buy back a cow, but everything he made seemed to go for buying food that Almaz had once been able to get from processing enset. Unexpectedly in 1998, Aberra became extremely sick with a fever and died a couple days later. Almaz, realizing that she alone must raise five children, gave her youngest son to another family in town at Aberra's funeral. Understanding Almaz's need for assistance, neighbors tried to call her more often to process enset, but dwindling numbers of enset plants in their fields made them unable to give her as much work as she needed. To help Almaz with all of the housework, her 15-year-old cousin Meseret came to live with her in 1999. Despite Meseret's help, they found it increasingly difficult to obtain enough food and care for the four children remaining at home. As a result, in 2000 her youngest son at home died suddenly with a fever only two years after her husband. Currently Almaz and Meseret continue to struggle to survive with Almaz's three remaining children, doing odd jobs and processing enset for neighbors as their primary sources of livelihood.

Figure 4. Almaz's household composition timeline



While her husband was alive and healthy, although they were virtually landless, poor, with few assets and not food secure, their household's activities were sufficiently diversified that they were able to make ends meet. As a poor family in the community, Almaz fed the family through a traditional patron-client relationship, processing enset for wealthier neighbors. However, these wealthier households had been continually harvesting enset heavily to cope with a recent string of grain crop failures and lower coffee prices. These short-term shocks were exacerbated by the longer-term process of soil fertility decline due to the loss of manure from reduced livestock numbers, causing enset to grow less vigorously. Without alternative sources of soil fertility improvement, even relatively wealthy households are unable to maintain enset production. This failure of the enset script highlights the need for its adaptation. The inability of wealthier households to modify the enset script to address the decline in soil fertility had a downstream effect on Almaz's household. The traditional patron-client relationship of outside enset processing that had always existed now no longer functions as effectively as it once had. Through these patron-client relationships, the soil fertility of wealthier households is indirectly related to the food security and well being of poor, almost-landless FHHs. The failure to address the soil fertility management aspect of the enset script affects both enset producing household and households that don't produce but process enset.

When Almaz's husband became sick, this triggered a chain reaction of asset erosion. Already poor and at risk, his sickness disrupted the household's precarious food security balance. His sickness led to the gradual reduction of his labor, his activities, and to livestock selling to cover the costs of treatment. The crisis of her husband's sickness and death forced the household into specialization (due to loss of husband's labor and skills) and Almaz sought to intensify her normal activity, enset processing. However, at the same time that she needed to intensify her activity of enset processing, wealthier neighboring households were facing severely reduced enset stocks and therefore requiring less outside enset processing. Not only had Almaz's household long ago consumed all of what little enset they had, but her wealthier neighbors had also severely reduced their enset stocks. First as a coping and then as a survival strategy, Almaz attempted to intensify the enset processing activity based on the failing enset script. Her coping and survival strategies, based on attempting to intensify enset processing, were tragically ineffective. As a result of the failure of these strategies, Almaz was forced first into non-erosive disaccumulation (selling cows, sending children away temporarily) and then into erosive disaccumulation (giving children away, cutting food consumption leading to dangerous levels of malnutrition). Almaz's problems had less to do with the shift from being a MHH to a FHH and the loss of adult male labor, etc. as it did with her continued reliance on intensifying an activity that couldn't be intensified (enset processing).

Both before and after her husband's death, Almaz's inability to diversify her livelihood activities was constrained by a number of factors. As a mother with young children at home, any activities that Almaz might undertake must allow her to work from her home. However, her limited skills and assets prevented her from engaging in potentially more lucrative craft activities. As a widowed woman with young children, Almaz is spatially constrained to her home. Few productive activities aside from enset processing are available in her community that meets her childcare constraints (enset processing for others permits her to bring her children to a neighbor's house). As a widowed rural woman, the prospects for migration are dim. How will she get access to more or better land, since remarriage for a widow is uncommon? What skills does she have that someone in a town would hire her? What initial capital does she have to start her own business? These are some of the factors that help explain the pressure FHHs commonly face and why they often do not remain female headed for long.

Almaz's oldest son, the likely successor to the land, is still living at home and is currently 11 years old (the two older sons given to a family in town are first in line, but are unlikely to be interested in returning to the land). In about ten years he will likely be interested in marriage and ready to inherit the land (assuming he is interested in farming rather than going off to town as is common). With few other options, rather than give up the little land and the home she has, Almaz believes she will try her best to manage until her oldest son at home is able to marry and take over the farm.

After her husband's death, Almaz's household was faced with a severe drop in male labor. This labor reduction is all that more dramatic when the number of mouths to feed is compared to Almaz's remaining labor. This relationship is commonly described using the consumer to producer (C/P) ratio (Chayanov, 1986).⁶⁸ Almaz's household composition timeline (Figure 4) was used to generate the C/P ratios in Figures 5 and 6. As its name implies, the C/P ratio is calculated by dividing the number of consumers by the number of producers. However, various

factors can be multiplied to the numbers of consumers and producers to reflect the impact of these factors on the C/P ratio. The raw C/P ratio (using the raw number of consumers divided by the raw number of producers) appears as the blue line in Figure 5. Economists commonly multiply the raw number of consumers and producers by age and gender specific coefficients reflecting individuals' relative contribution to consumption and production (green line in Figure 5).⁶⁹ Dove calculated the ratio as the energy requirements of the consumers divided by the energy requirements of the producers to show the ratio in terms of human energy needs (the same can be done for protein).⁷⁰ World Health Organization human energy and protein requirements were used to calculate both the energy (red line) and protein (purple line) C/P ratios for Almaz's household found in Figure 6.⁷¹

Figure 5. Raw and coefficient consumer to producer ratios

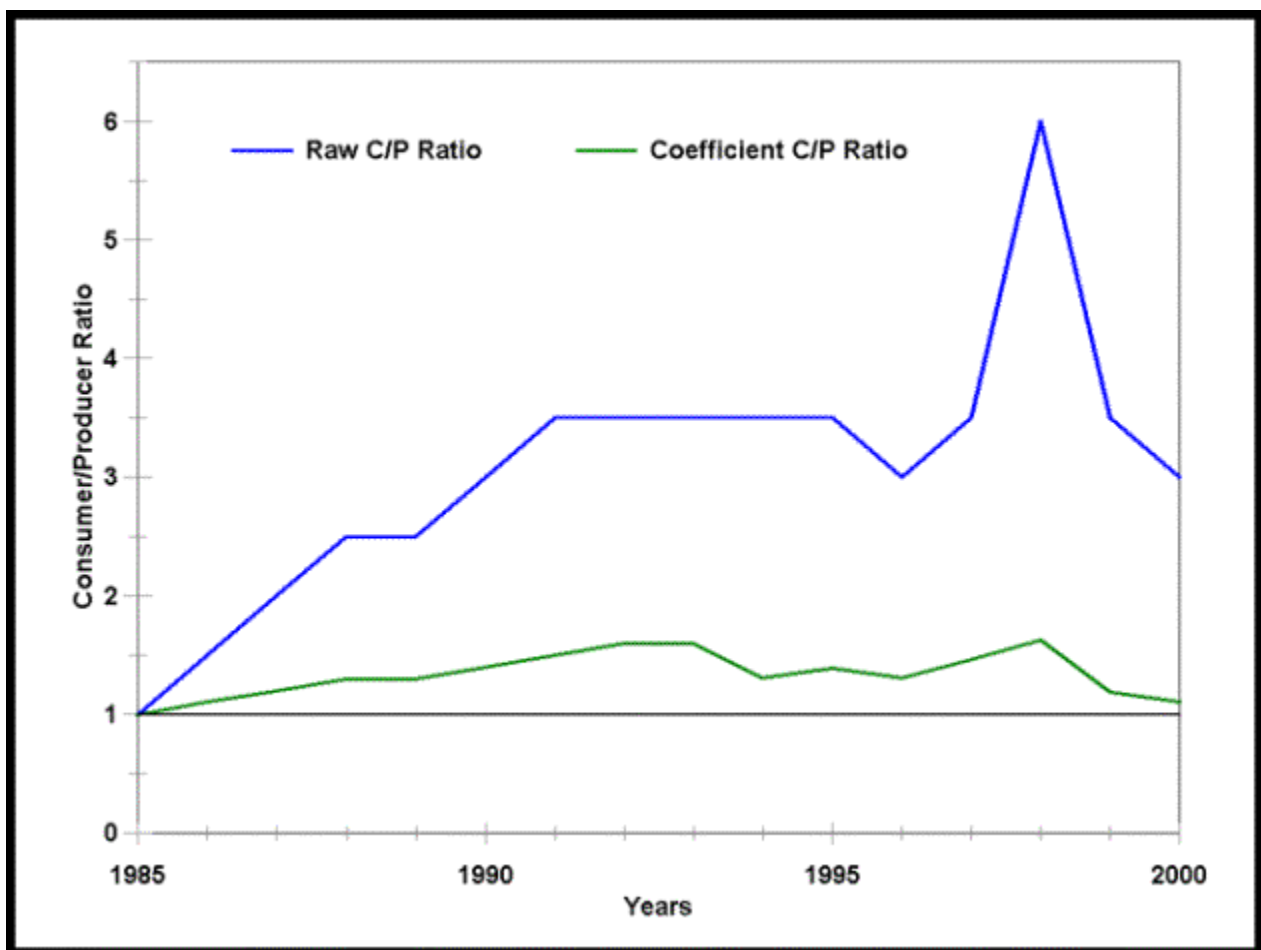
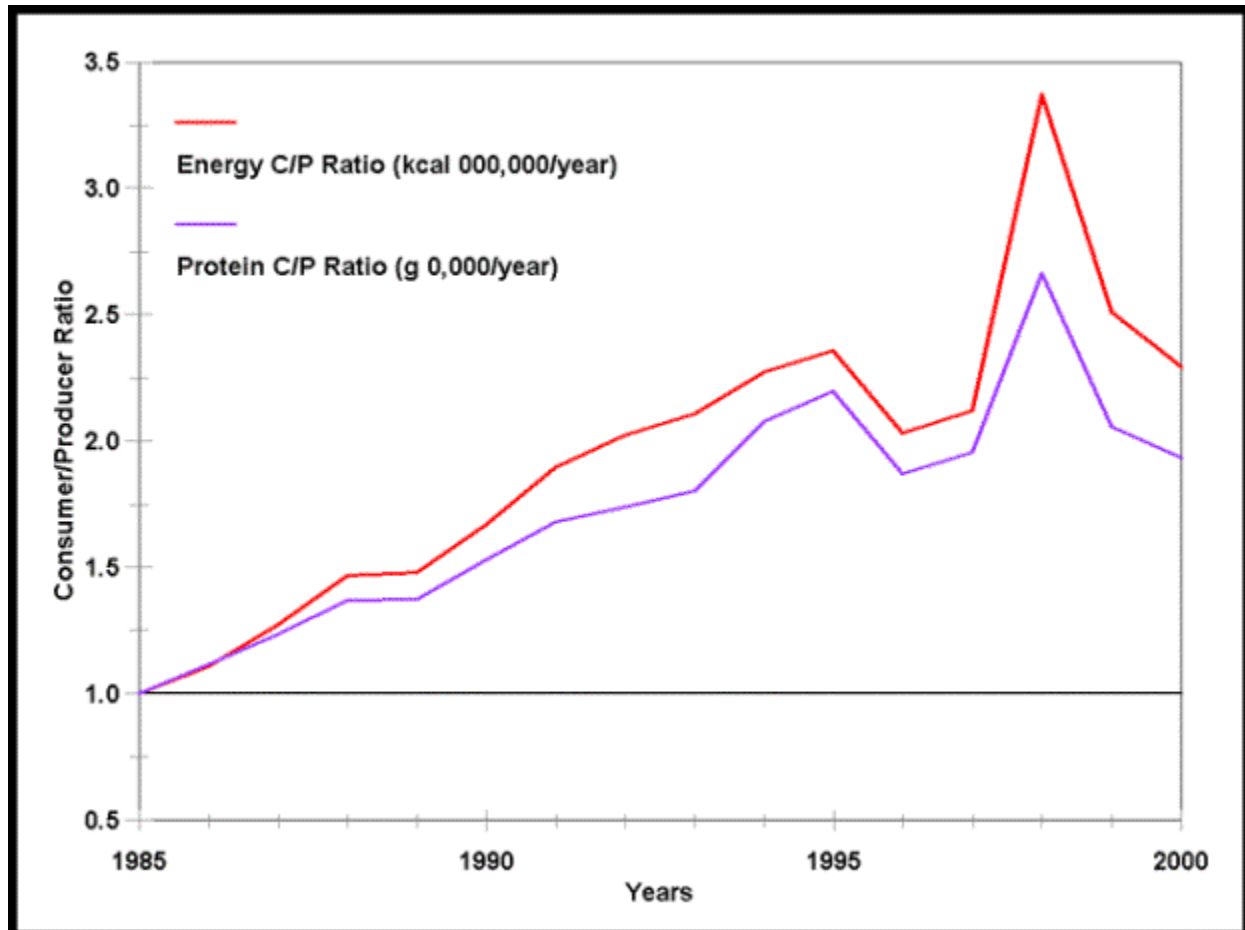


Figure 6. Energy and protein consumer to producer ratios



Once Almaz and her husband got married and started having children, all four C/P ratios began to rise as the number of consumers increased (more children) and the number of producers was static (2 parents). By the early 1990s there are 5 children under the age of 7 and only 2 parents. During this time the raw C/P ratio rises and levels off while the coefficient C/P ratio increases and then begins to decline due to their oldest daughter becoming old enough to help Almaz with housework. However, during the early 1990s the energy and protein C/P ratios continue to increase as growing young children require more food. In 1995 the effects of her husband's worsening illness begin to be reflected in the C/P ratios when they are forced to send their oldest son to live with her parents. The son's leaving positively affects all four of the C/P ratios, providing for a temporary decline in the C/P ratios after he leaves. Yet, despite sending a son away, as the children continue to grow (increasing the consumption side of the equation) so does the C/P ratio. In 1997, as one child is born, another is sent away, helping to keep down the C/P ratios. In 1998 when her husband dies a producer is lost and the C/P ratio jumps dramatically. The imbalance between consumption and production at this point is extreme.

With few other livelihood options, Almaz chose to bring in her young cousin Meseret to help. Notice the dramatic effect on the C/P ratios when she arrives in 1999. Faced with the inability to remarry, diversify, intensify, or migrate, Almaz chose to manipulate her household's composition to address the unsustainable imbalance between consumption and production.

With the addition of Meseret as another producer, the C/P ratios in most cases fall back to the levels before her husband died. Meseret will likely live with Almaz until she is ready to marry in about 5 years. However, Meseret's presence in the household will provide Almaz with the childcare assistance she needs until her youngest daughter is able to be home alone. When Meseret marries, that leaves only about 5 years before Almaz's oldest son remaining at home is ready to marry and take over the farm.

Household composition manipulation like Almaz's suggests that this type of coping and survival strategy may be more widespread in Sidama than previously considered. In this case study, household composition manipulation could clearly be classified as a survival strategy. However, instances can be identified where household composition manipulation could be considered accumulative, adaptive, or coping strategies.

SCRIPTS POINT TO HOW SOIL FERTILITY CAN BE IMPROVED

The existing enset script is failing and must be modified if the enset system is to continue to provide Sidama households with a food security livelihood. Everybody uses and follows scripts and Schank and Abelson point out that most human knowledge is contained in scripts.⁷² Therefore, achieving changes in soil fertility management practices will not be possible without script modification. Script modification only occurs through the process of planning.⁷³ Expert farmers interviewed during this study are already doing extensive planning and testing to modify their scripts to meet existing conditions. The planning and testing that these experts have done has resulted in the development of successfully modified enset production and processing scripts. Based on interviews with non-expert farmers, these farmers are also capable of planning, but unlike experts, they need assistance undergoing the often arduous planning and testing process and require encouragement to successfully complete the script modification process. Scripts can be modified, but not outside this difficult process of planning and testing. Participatory action research can play an important role in helping farmers as they adapt their scripts to current conditions.⁷⁴

Script documentation provides an important tool for linking farmer and scientific knowledge. The main purpose of documenting scripts is to help researchers understand the intricacies of farmer practice. Documenting scripts provides researchers with a systematic method for understanding how and why farmers do what they do. Scripts are an important gender analysis tool for systematically identifying who does what under what conditions. Scripts clearly identify key soil fertility management decisions that farmers must make. Scripts allow for the identification of the specific aspects of soil fertility management practice that is failing and those that are functioning effectively.⁷⁵ From these failing sections of scripts, decision trees can be developed for those crucial decisions to describe constraints and suggest opportunities for modification of farmer practice. Only after researchers understand these management practice intricacies are they able to apply the scientific body of knowledge appropriately to a farmers' given context.

The enset script presented here can be used as an example of this suggested process. The critical point where the enset script currently fails is in maintaining the soil fertility of enset land when households cannot keep large numbers of livestock. The logic of the script depends on vigorous enset growth. Low soil fertility, due to the severe reduction in manure, reduces the

vigor of enset growth. Repeated decisions deal with the application of manure and more recently to the use of inorganic fertilizer. Script documentation is necessary for researchers to understand the answers to questions such as: What are the decision criteria for these critical decisions? How are these decisions structured? Only after researchers are familiar with farmer management practice are they ready to assist farmers with ideas on alternative production practices that meet their household's constraints.

Based on case study interviews, farmers report that depressed coffee prices, recent poor coffee harvests, slumping eucalyptus pole demand (following the post-1992 revolution building boom), limited fertilizer availability, and unavailability of credit makes even the limited use of inorganic fertilizers on enset extremely unlikely in the near future. Sixty-five percent of households claim that grazing land shortage is the largest constraint to keeping more livestock.⁷⁶ Farmers lament the loss of livestock (primarily cows, 93% of households keep cows) but are unfamiliar with the various techniques for intensifying fodder production necessary for keeping livestock on less land (88.4% do not store hay for the dry season). Given the current problems associated with obtaining inorganic fertilizer and since farmers want to keep more cows (40.4%), it seems that intensification of livestock production appears to be the most promising approach (best-bet) for modifying the enset script to maintain the soil fertility of enset land and allow enset production to remain viable.

This researcher-derived starting point, based on a best-bet approach, should serve as the initial input into a farmer-driven planning process. Discussions with farmers can begin with analyzing the feasibility of various fodder production techniques. Lessons learned from expert farmer planning may serve as a guide for non-expert farmers during the process. As farmers progress through the planning process, testing should follow. Work with farmers should be done to test the various fodder production techniques farmers think appropriate.⁷⁷ The role of the facilitating organization should be to encourage and assist the farmers through the planning and testing process. The process suggested here is not new, but is implemented with standard farming systems research and extension and participatory methodology.⁷⁸ The only new aspect of this process suggested here is the introduction of scripts as a methodology for systematically organizing the information typically gathered about farmer management practices. Due to the systematic rigor necessary to build a coherent script, script documentation helps organize data on farmer practice that might otherwise be lost among the mass of project data commonly gathered.

This process may seem long, complicated, and impractical on a large scale compared to existing agricultural extension practices. However, effecting changes in soil fertility management practices requires a process of learning and adaptation by the farmer. The process may seem tedious, but people's cognitive processes cannot be ignored or rushed. Continued failure to address the planning, adaptation, and learning aspects involved in changing farmer soil fertility management practices in agricultural extension will lead to continued project failure.

SUMMARY

This paper has claimed that population growth has led to the reduction in grazing land and has therefore caused a reduction in the number of livestock (primarily cattle) held by each

household.⁷⁹ The reduction in household livestock numbers has led to the reduction of manure applied to enset plants that require regular soil fertility amendments to support vigorous enset growth.⁸⁰ Without vigorous enset growth, the logic of the enset script fails. These FHHs, who often depend on their wealthier neighbors for processing enset to remain food secure, suffer when the enset production of wealthier households declines. The process described in the case study presented here serves as an indicator pointing to the need for enset script modification.

This paper has discussed men and women's production roles, the gender division of labor, the gender division of skills and cultural knowledge, and gendered access to capital within the enset system. This author feels that the discussion of these issues is necessary to understand the relationship between the process of soil fertility decline and households' choice of livelihood strategy. Data on enset production and processing scripts has been analyzed within this framework. The case study of a FHH presented here has shown that the food security of this household, through the livelihood strategies it chooses, integrates it into a community-wide process of enset land soil fertility decline. Understanding the connection between the process of soil fertility decline and choice of enset-based livelihood strategies that this case study illustrates is necessary for the design of effective food security policy in the Sidama Zone.

Farmers report that the old ways of doing things (represented by the enset script documented here) are no longer able to meet their household food security and other objectives. Some farmers are engaged in modifying the enset script, searching for new ways to maintain the fertility of enset fields (intensification), while others are trying new combinations of livelihood activities (diversification) to achieve food security. However, most farmers seem understandably slow to adapt in the face of the bewildering changes they have experienced during the Twentieth Century. The large majority of farmers need assistance to undertake the planning and testing necessary to modify the scripts on which they depend for food security.

Soil fertility research must move beyond just technical feasibility assessments; ultimately farmers must decide what mix of soil fertility improvement technologies work within their livelihood system.⁸¹ Many soil fertility improvement programs in Ethiopia (and elsewhere) have failed partly as a result of not considering how these technologies fit within the complex contingencies involved in various household livelihood strategies.⁸² To address this deficiency, scripts are suggestive of ways that various soil fertility improvement technologies could be incorporated into existing livelihood strategies with the greatest likelihood of adoption. Rather than national or non-governmental organization (NGO) extension staff designing regional soil fertility improvement technology adoption programs as is the norm, it is concluded that since farmers have traditionally developed and use scripts to manage soil fertility, the farmers themselves should be involved in the participatory planning and testing of alternative scripts to improve soil fertility. It is argued that farmer-developed scripts that incorporate soil fertility improvement technologies will more likely "fit in" with the rest of the household livelihood strategy better and will therefore be more successful than the more common region-wide, blanket soil fertility improvement programs.

Notes

1. Due et al., 1998; Due & Gladwin 1996; Verma, 2001
2. Scoones, 1998; Ashley, 1999; Brock, 1999; Turton, 2000; Farrington, 2001

3. Scoones, 1998
4. Schank and Ableson, 1977
5. Degife, 2001
6. The Sidama Zone is composed of nine administrative districts called *woredas* (Amharic). Each of these nine *woredas* contains lowland, midland, and highland areas. Three peasant associations (the next administrative level below *woreda*) were randomly selected within each of a *woreda's* lowland, midland, and highland areas. Ten households were selected randomly from each peasant association list. To examine FHH food security regionally, at least one FHH was chosen from each peasant association, thus ensuring that at least 10% of the sample is composed of FHHs. 9 *woredas* x 3 agroecological zones x 10 households = 270 households.
7. Schank & Abelson, 1977, p.41
8. Chayanov, 1986; Haddad et al., 1997
9. Campbell, 1999
10. Gladwin & Butler, 1984; Gladwin, 1984
11. Hussein & Nelson, 1998
12. Decron & Krishnan, 1996
13. Devereux, 1999
14. Devereux, 1999, p. 8
15. Due to the poverty focus of the livelihoods literature the more vulnerable, dis-accumulative end of the continuum has been conceptually more developed than the better-off, accumulative end.
16. Devereux, 1999
17. Hussein & Nelson, 1998
18. Locality is perhaps a better term for this spatial dimension, rather than the term migration that refers to a particular strategy.
19. Devereux, 1999; Decron, 2001
20. Devereux, 1999
21. Ibid.
22. Degife, 2001
23. Gamachu, 1977; SZPEDD, 1997
24. Smeds, 1955; Huffnagel, 1961; Shack, 1963; Westphal, 1975; Kefale & Sanford, 1991; Tsedeke et al., 1996
25. Brandt et al., 1997
26. Kefale & Sanford, 1991; Endale et al., 1996
27. Kelbessa et al., 1996; Spring et al., 1996
28. Ayele & Berhanu, 1996
29. Werner & Schoepfle, 1979
30. Kefale & Sanford, 1991; Gebre, 1995; Spring et al., 1996
31. The English terms used in Box 1 for the stages of enset growth refer to the typical age of plants in mid-altitude areas (*woinadega*). Enset growth appears to be largely temperature dependent, since plants mature in low-altitude areas (*qola*) in approximately 4 to 6 years, mid-altitude areas in approximately 6 to 8 years, and in

high-altitude areas in approximately 10 to 12 years. Since the schema of stage names in mid-altitude and high-altitude areas (dega) is the same, it therefore seems that stage is based more on size than on age (Clifton Hiebsch, personal communication). That the length of each of the stages presented here is approximately one year is a convenient coincidence caused by the rate of enset plant growth in mid-altitude areas, not an emic characteristic of each stage. If lengths of time were given based on interviews from low-altitude and high-altitude areas, the time would likely be shorter and longer respectively. Etic characterizations of enset stages are based on estimations of enset plant size (clone dependent girth and height, spatial relation to neighboring plants, etc.) that outsiders have difficulty understanding. Plant age is used here for simplicity.

32. The Sidamic terms of stage names are placed in parentheses following the English description of the stage.
33. Westphal, 1975; Getahun & Tenaw, 1990
34. Westphal, 1975
35. Brandt et al., 1997
36. Kefale & Sandford, 1991
37. Smeds, 1955; Westphal, 1975; Dessalegn, 1996; Hiebsch, 1996
38. ENI, 1981
39. Dessalegn, 1996; Quimio & Mesfin, 1996
40. Tibebe et al., 1994
41. McCabe, 1996
42. Ibid.
43. Befkadu & Berhanu, 2000; Getachew, 1995
44. Smeds, 1955; Shack, 1963; Brandt, 1996; Tsedeke et al, 1996
45. Dessalegn, 1996
46. Degife, 2001
47. Smeds, 1955; Raya, 1988; Getahun & Tenaw, 1990; Alemayehu et al., 1995; Bull et al., 1995; Spring et al., 1996; Degife, 2001
48. Asnaketch, 1996
49. Degife, 2001
50. Ibid.
51. Ibid.
52. Joireman, 2000
53. Nine percent of households struggle with identifying a successor which is suspiciously close to the 10% of FHHs (Degife, 2001).
54. Tibebe et al., 1994
55. Tibebe et al., 1994; Spring et al., 1996
56. Shaqisha is another type of enset processing (not discussed here for simplicity) intended for rapid maturation and early consumption of enset products before products from the primary processing (hassa) have matured.
57. Gladwin & Butler, 1994; Werner & Schoepfle, 1979
58. Schank & Abelson, 1977
59. Spring et al., 1996; Brandt et al., 1997

60. One hundred plants was chosen since this is the number of plants processed in the now common small primary processing (small hassa).
61. Befekadu & Berhanu , 2000, p. 1-3
62. Ibid., p. 52-59
63. Ibid., p.85
64. Ibid., p.59-62
65. Degife, 2001
66. Ibid.
67. See Dessalegn, 1996 and Tibebe, Sanford, and Kindness, 1994 for a description of this process in neighboring Woliata.
68. When the number of consumers is higher than the number of producers (C/P ratio <1), the household is under stress. When the number of consumers and producers are the same (C/P ratio =1), the household is in a good position. If the number of consumers is less than the number of producers (C/P ratio <1), a situation where outside household members that are not consuming send remittances, the household is in an excellent position.
69. The coefficients found in Tables 7 and 8 were used in the calculation of the coefficient consumer producer ratio found in Figure 5.

Table 7. Consumer units

Age categories	Male coefficient	Female coefficient
0 to <6	0.2	0.2
6 to <12	0.4	0.4
12 to <16	0.5	0.5
16 to <35	1.0	1.0
35 to <50	1.0	1.0
>50	0.8	0.8

Table 8. Producer units

Age categories	Male coefficient	Female coefficient
0 to <6	0.0	0.0
6 to <12	0.0	0.6
12 to <16	0.5	1.0
16 to <35	1.0	1.0
35 to <50	1.0	1.0

>50	0.8	0.8
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70. Dove,1984
71. World Health Organization, 1985
72. Schank & Abelson, 1977
73. Ibid.
74. Sutherland & Sanford 1999a; Sutherland & Sanford 1999b
75. Gladwin & Butler, 1984
76. Degife, 2001
77. Sutherland & Sanford 1999a; Sutherland & Sanford 1999b
78. Hildebrand, 1986; Chambers, 1997
79. McCabe, 1996
80. Asnaketch, 1996
81. Chambers, 1997
82. Yeraswork, 2000

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