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ARTICLES

Learning to Survive Ecological Risks among the Sidama of Southwestern Ethiopia



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ABSTRACT

Sidama farmers rely on rain-fed agriculture and experience a highly variable natural environment. Recurrent drought, erratic rainfall, and crop and livestock loss are common in mid- and lowland areas, but local people are not passive victims of the changing environment—they use accumulated knowledge and skills to respond to and buffer ecological changes. Based on freelists and in-depth interviews with 70 adults and 50 adolescents, this paper describes how the Sidama conceive of ecological risks, survive difficult times, and learn to be resilient. The results indicate that food shortage and drought are salient risk factors. While local people think the future is unpredictable, they have diverse and complex knowledge about saving, trading and farming that help them cope with environmental challenges. Fifty adolescents interviewed reported that they learned diverse survival strategies from parents, fellow adolescents, and other adults. Interviews with adolescents and adults indicate that the Sidama use multiple methods, including teaching, to transmit cultural knowledge and skills about how to survive ecological risks.

INTRODUCTION

Since the early 20th century, the Sidama of southwestern Ethiopia have experienced profound changes due to population growth, changes in government policies, climate variability, and market forces such as the expansion of coffee and other cash crops (Brøgger 1986:49,57; Hamer 2009; Hameso 2014). The Sidama living in low and midland areas currently experience erratic rainfall, recurrent drought, crop failure, livestock loss, and subsequent food shortage (Quinlan et al. 2015).

Ecologists Berkes and Jolly (2002) and anthropologists Moran (2006:13-15) and Nazarea (2006) argue that local people are not passive victims of ecological uncertainty—they have a philosophy and accumulated knowledge acquired through generations by cultural transmission to help them understand environmental variability and survive difficult times. This paper examines how Sidama farmers identify and define ecological risks and how they construct knowledge sets for survival. The paper also compares adults' and adolescents' risk perceptions, and examines how

adolescents acquire the knowledge that prepares them for future social-environmental shocks such as drought, rainfall failure, and food shortage. Data from adults and adolescents indicate that diverse forms of socially acquired knowledge and skills enable the Sidama to respond to various forms of culturally demarcated times of hardship.

BACKGROUND ON THE SIDAMA

The People and their Ecology

The Sidama are Cushitic speakers located 270 kilometers south of Ethiopia's capital, Addis Ababa. Sidamaland constitutes one of the administrative zones in the Southern Nations, Nationalities and Peoples Region (SNNPR). In 2013, the total population of the Sidama was 3,514,491 living in an area of 6,538 km² with a population density of 536/km² (Central Statistical Agency of Ethiopia 2013). The average household size is 4.9 persons. The majority of Sidama are smallholder agriculturalists while a few live in urban areas (8.8 percent).

The Sidama population has increased dramatically in the last 30 years—more than doubling in size. The total population was 1.5 million in 1984 (Hamer 1987), 2 million in 1994, about 3 million in 2007, and 3.5 million in 2013 (CSAE 1994, 2008 and 2013). Increase in population size had a significant impact on land fragmentation, which has become a source of food insecurity and interpersonal and ethnic conflicts (Alan 2011:163; Quinlan et al. 2015).

The Sidama were incorporated into the modern Ethiopian state in the 1890s, which impacted their traditional economic and socio-economic life. The Imperial administration introduced the **gabar** system, and the people had to pay heavy taxes to **balabats** ('landlords'). The system reduced Sidama peasants to the status of tenant (Hamar 1987:132). The **Derg** government, which took power in 1974, abolished the gabar system and instituted land reform to redistribute the land to the peasants through

government-established peasant associations. The state held land-ownership rights, and the government set the limit of the land size that an individual peasant could own (Quinlan et al. 2015). As a result of land reform, farmers were relieved from the Imperial regime's landlord-tenant relationship and the burden of paying tribute to the landlords. However, in the late 1970s, the government introduced cooperative farming, confiscated peasants' smallholdings, and forced coffee producers to sell through the cooperatives for a lower price than they could obtain in the markets. These policies provoked strong local resistance against the government, and people experienced armed conflict and revolts (Aalen 2011; Vacchiato 1985).

The Federal Democratic Republic of Ethiopia (FDRE), which came to power in 1991, reversed the military government's policies regarding traditional practices and religious freedom (Aalen 2011:97; Freeman 2002:42), and thus some traditional practices were revived. This was followed by the rapid expansion of Protestantism due to massive and pronounced proselytization by local missionaries that was not possible during the previous regimes. Added to these influences was dissatisfaction with possession spirits and some indigenous rituals, as well as expectations of a better future through Christianity (Hamer 2002).

In the 1990s, the Sidama were introduced to modern agricultural inputs such as seeds and chemical fertilizers. Recent research (Quinlan et al. 2015) and my own interviews indicate that the fertilizer improved maize yields at the beginning--and that it had been important to local people to increase yield per hectare--but price hikes in the global market limited its accessibility. Farmers could not afford the increasing cost of fertilizer--100kg of fertilizer was approximately 60 Birr (<\$3USD) in the year 2000, but was increased to 800 Birr (~\$40USD in 2012 (Quinlan et al. 2015; Quinlan et al. in press) and 1250 birr (~ \$62.5USD) in 2014. This has had a significant effect on crop productivity--since soil has become dependent on chemical fertilizer--and

increased food prices and food shortage even during the seasons of good rains.

Sidama Agroecology and Risk

The agroecology of Sidamaland varies between highland (above 2600 meters above sea level) and lowland altitude that ranges from 560-1700 meters above sea level (Quinlan et al. 2016). Subsistence activities and experiences of ecological risks vary along ecological zones and geographic variations (Quinlan et al. 2015). For example, herding livestock is a predominant activity in the lowlands. Sidama raise zebu cattle (*Bos primigenius indicus*) primarily for dairy and fertilizer (Quinlan et al. 2014; Quinlan et al. 2015). In the highlands and midlands, basic subsistence relies upon **ensete** (*Ensete ventricosum*) and maize, respectively. Ensete, which the Sidama call **weese**, is a banana like root and stem plant that is grown in midlands and highlands of Southern Ethiopia. The majority of the Sidama depend on weese for subsistence and to buffer uncertainty (Quinlan et al. 2014; Regassa and Stoecker 2012). Cash crops such as coffee and **khat** (*Catha edulis*) predominate at middle altitudes. Khat is a plant that contains a stimulant (cathinone) when its leaf is chewed.

Compared to the lowlands and midlands, the highlands tend to receive more rainfall. People in the highlands of Hagereselam, Arebegona, and Besna districts grow barley and wheat as secondary food and cash crops, although the productivity of these crops has significantly declined in recent years due to land fragmentation. Rainfall at the middle and high altitudes were sufficient to provide for relatively productive plant life in the past (Hamer 1987:13). However, since the 1990s, all agroecological zones received highly variable rainfall. Table 1 shows the mean and variability in annual rainfall for 10 years in the three agroecological zones. The table indicates that the amount of rainfall is substantially lower—and that the variability is much greater—in the mid-lowland area as represented in the Boricha district.

Table 1. Mean annual rainfall in three Sidama agroecological zones.

Year	Boricha (Mid-lowland)	Yirgalem (Midland)	Hagereselam (Highland)
2003	91.1	71.0	81.0
2004	91.8	69.4	103.0
2005	11.5	91.7	119.6
2006	90.0	117.7	109.3
2007	92.9	123.5	138.3
2008	77.3	102.0	101.4
2009	66.2	90.0	103.9
2010	104.9	102.3	146.4
2011	96.6	71.0	133.7
2012	50.1	95.5	103.2
Mean	77.2	93.4	114.0
SD	28.2	19.0	20.2

Source: Compiled from Ethiopian Metrological Agency data for years 2003–2012.

Rainfall variability over the last two decades has resulted in changes in the production calendar, productivity of crops and food availability. Hameso (2014) studied the perceptions of and impact of climate change among the Sidama and found that variability of rainfall patterns caused changes and/or delays in the production calendar. Low altitude crops have started to grow in high altitude areas, while some high altitude crops no longer exist in parts of the highlands. The first author also witnessed the expansion of maize and khat in the Sidama highlands—often replacing weese. The expansion of cash crops like sugar cane and coffee is also increasing in higher altitudes. More recently, Quinlan and colleagues (2015) found that environmental shocks such as drought and crop loss are disproportionately affecting the Sidama in different areas. In the Arbegona district, drought, rainfall failure, and crop loss were almost non-existent while they were major stressors for Boricha and Hawassa Zuria districts.

Boricha district, the field site for this study, is the part of the Sidama lowlands, which have been experiencing unreliable rainfall due to the rapid

climate change since the 1990s (see Table 1 for patterns of rainfall variability). The altitude of the district ranges between 560 and 1700 meters above sea level (Quinlan et al. 2015). There are short rainy months (March - May) and the longer rainy months (June - October). In a normal year, annual rainfall in Boricha ranges from 56-180 mm (Boricha District Agriculture and Rural Development Office 2006).

Mixed subsistence agriculture supports the livelihood of over 95 percent of the population. Boricha subsistence strategy is relatively distinct from most of Sidama districts in that both weese and maize equally support the livelihood of the community (Quinlan et al. 2015). Besides, haricot bean, **teff** (*Eragrostis tef*), sweet potato and other vegetables like cabbage, onion, plus fruits like banana and avocado, also grow locally. Livestock, sugar cane, khat, and coffee serve as sources of cash income in Boricha and, in most cases, informal marketing supplements farming activities. Less than 5 percent of urban dwellers subsist by trading activities such as shop keeping, transportation services with horse/donkey-carts, khat trading, and daily labor--these are the most common non-farm income sources (CSAE 2008).

ECOLOGICAL RISKS AND CULTURAL LEARNING

Defining Ecological Risk and Resilience

Research demonstrates that environmental risk perception influences subsistence strategies, parental investment, marital age, fertility decisions, family size, childcare, gender relations, and social networks (Girum et al. 2008; Hewlett 1991; Quinlan 2007, 2006). Risk and resilience are interconnected concepts in the sense that knowledge and perception of ecological variants determine how people prepare for, respond to, and adapt to uncertainties and variants (Girum et al. 2008; Ronan and Johnston 2005:18; Tucker 2007).

A number of studies have been conducted on how people in different socio-cultural settings perceive

and respond to environmental risks. Leiserowitz (2006) examined factors that influenced American adults' perceptions and policy preferences about climate change and found that various psychological and socio-demographic factors such as affect, imagery and values, gender, political party affiliation, and social group influenced public perceptions and policy preferences to climate change. The study identified socio-political factors that influenced risk perception and individuals' preference to policy options, but this study was limited because informants were not directly impacted by climate change in their day-to-day activities. Deshingkar (2012) conducted a cross-cultural study that examined the relationships between environmental change and migration and found that climate change is a push factor for migration in developing countries whereas remittances to home countries promoted the resilience of poor households during environmental and economic shocks. The study provided insights into economic tradeoffs, but was also limited because it did not consider how local feelings or perceptions impacted behavior.

Shared indigenous ecological knowledge and belief systems are important to ensure the survival of small-scale cultures during ecological uncertainties, but overlooked is the need to consider the role of response options of local people in maintaining the resilience of social-ecological systems. Leslie and McCabe (2013) indicate that not all strategies that are available for local people during environmental and socio-economic shocks enhance survival of individuals and communities as a cultural group. Individuals use their ecological knowledge to make choices from the portfolio of survival options. Also, previous studies of local peoples' perceptions and responses to ecological risks seldom, if ever, include children's perceptions of the risks, and how children acquire specific coping strategies. This paper examines how Sidama farmers, who are currently experiencing environmental uncertainties rank ecological risks (the most to the least risky) and prioritize the strategies they use to survive these risky times. Sidama adults' perceptions are then compared to what adolescents

know about risk factors and survival strategies, and we also explore how adolescents acquired these skills and knowledge.

Moran (2006) and Boyd et al. (2011) argue that neither the behavior nor the requirements of survival are obvious to human agents; group members need to learn the knowledge, skills, and practices in order to adapt to the social and natural environment. Learning ecological and social skills to make a living during childhood is an essential aspect of human experience that enhances adult competence (MacDonald 2010; Zarger 2010). Ethnographic studies also demonstrate that learning ecological knowledge is important for coping with ecological risks. For example, Tucker (2007) found that, in the Mikea of Madagascar, shared ethnotheories acquired through social learning were vital for individuals to adapt to variability in rainfall patterns and reduce risk of food shortage.

Evolutionary Approaches to Social Learning

Two basic questions arise regarding the transfer of knowledge from generation to generation: From whom do children learn? And, how do children learn? In regards to the first question, evolutionary theorists interested in social learning identify three general mechanisms: 1) learning from parents, or vertical transmission; 2) learning from slightly older friends of the same generation, or horizontal transmission; and 3) learning from non-parental adults, or oblique transmission (Hewlett et al. 2011; Hewlett and Cavalli-Sforza 1986; Reyes-García et al. 2009). The second question refers to the different processes individuals may use to acquire knowledge or skills, such as imitation (accurate copying what others do), emulation (selective copying of others' behavior), observation, participation, and teaching (Gergely and Csibra 2006; Hewlett et al. 2011). While cultural anthropology and developmental psychology studies agree that answers to the two basic questions are interwoven, debates exist as to from whom children learn and how they learn it (Gergely and Csibra 2006; Hewlett et al. 2011; Lancy and Grove

2010). Previous ethnographic studies from the Aka (Hewlett and Cavalli-Sforza 1986) found that vertical transmission (learning from parents) dominated other paths in most types of skills and knowledge, while Reyes-García and colleagues (2009) examined the transmission of ethnobotanical knowledge among the Tsimane and found that learning from non-parent adults (oblique transmission) was the dominant path of transmission. Zarger (2010) emphasizes the role of horizontal transmissions of environmental knowledge among children. Another debate exists on whether or not teaching occurs in the transmission of local knowledge and skills. Studies by cultural anthropologists (Lancy and Grove 2010; Zarger 2010) indicate observation, imitation, and participation are the primary processes of social learning and that teaching does not exist, whereas developmental psychologists and some ethnographic studies suggest teaching is part of human nature (Gergely and Csibra 2006; Hewlett et al. 2011). This study addresses both debates by considering how the knowledge and skills that help people to survive difficult environments are acquired among the Sidama adolescents.

METHODS

Data were collected during three field visits to Boricha communities, each for two months, between 2012 and 2014. The first author is Sidama and speaks the language. He first visited the Boricha district in 2008 for two and a half months before returning in 2012 and 2013. His knowledge of Sidama language and previous familiarity with the community enhanced informal and systematic interviews with local people. Before conducting semi-structured interviews with individual informants, open-ended group discussions were conducted with community members.

Opportunistic and snowball sampling techniques were used to select the sample of 70 adults (35 females and 35 males) between 25 and 70 years-old and 50 adolescents (25 females and 25 males) between 12 and 17 years-old. Adolescents were

not the children of the adult informants but a few of their parents participated in open-ended interviews.

First, participants were given a brief introduction to the research objectives after which they were asked to list the times or situations that were difficult to survive. Second, participants were asked to list the knowledge and/or skills they felt helped them survive these difficult times. The informants were asked to describe in some detail each of the items they listed under 'difficult times to survive' and 'knowledge and skills that enhanced survival'.

The first author conducted many of the interviews during a house-to-house demographic survey. Consequently, most interviews were conducted at the informant's homestead and only a few were conducted at village gathering places. Each informant was asked to verbally provide his/her freelists privately in order to prevent bystanders from influencing the responses. Likewise, adolescents were interviewed privately without the presence of their parents or friends.

In addition to freelist questions, in-depth semi-structured interviews were conducted with adolescents on from whom and how they learned survival knowledge.

Salience scores for both adults' and adolescents' freelists were calculated using the techniques described by Quinlan (2005:8). This technique has two steps. First, salience of items freelisted by each individual is calculated. Items are ranked on an individual's list inversely, i.e., final item listed equals one, and items increase by one moving up the list. Then, the rank is divided by the number of items the individual listed. Second, composite salience is calculated by summing all salience scores each item and then divided by the number of informants. In order to compare adults' and adolescents' risk perceptions, principal component analyses and multivariate linear regression were used.

RESULTS

Adult Conceptions of Risk Factors

The informants listed between one (low) to seven (high) ecological risk factors that impacted survival. A total of 13 different items were identified, but Table 2 lists only the top nine ecological risk factors with a salience score of two and above. The salience scores indicate that food shortage and drought were perceived to be the most significant risk factors for the respondents who provided freelists.

Table 2. Salience of risk factors among adults.

Item	Σ salience (N=70)	Composite Salience (Σ/N)
Food shortage	52.67	0.75
Drought (rainfall failure)	43.61	0.62
Baashe	8.43	0.12
Disease	7.23	0.10
Armed conflict	5.78	0.08
Death of spouses/parents	3.95	0.06
Food price escalation	3.52	0.05
Money Shortage	3.24	0.05
Alcoholism	2.05	0.03

Descriptions of Ecological Risk Factors

Food shortage: Food scarcity/absence occurs due to various reasons including crop failure caused by delay or absence of rain, high food price, or inadequate yields from the harvest. Most food shortages occurred in **hawado** if people experienced crop loss to rain fall failure in a preceding season. Informants said that hawado is difficult because it is the time of the year where harvest from previous seasons is finished and thus the upcoming harvest is not ready. The Sidama call this time **lamiledo**, a transitional period. Lamiledo becomes worst in a year with harvest losses.

Drought season: This refers to the unexpected absence or delay of rainfall. Informants said that the absence of rain between March and June was critical, leading to multifaceted problems in the following season. It caused delays in farming food crops and resulted in a food shortage and subsequent malnutrition. The drought also caused loss of pasture, which reduced dairy yields or—in the worst case—death of livestock. The period between 2001 and 2004 was the most difficult during which local people lost crops to drought and faced a chronic food shortage and eventually became dependent on external food-aid. Data available in the district's Agriculture Office (2006) indicated a 78 percent loss and a 53 percent loss in crop yields due to rainfall failure for the years 2001 and 2003, respectively. Quinlan et al. (2016) reported that 24 percent of the informants in Boricha experienced crop loss in the last five years.

Baashe: This is a generic term in the Sidama language for describing undesirable resource management. It connotes 'scarcity in the midst of plenty' and includes social problems and relationships. For example, people might farm a large piece of land but produce little food. Food prices might escalate when they are expected to be low. Sometimes people seem to have a lot of resources but they are unable to save. In terms of behavior, baashe refers to a situation where people behave outside norms. For instance, children become disobedient; respect for power of elders erodes; local self-help networks become dysfunctional. Hamer (2009:7) describes the same situation as '**atote shima**' meaning "little satisfaction" to explain the contradictions--in the early 1970s, people seemed to have high cash income from coffee sale but were not satisfied. They valued individualism over collectivism and neglected the authority of elders over younger generations.

Health risks: Boricha experiences seasonal as well as sudden outbreaks of deadly diseases. Malaria and diarrhea were mentioned during the interviews as common in the area. Informants mentioned that waterborne diseases were severe during drought

seasons because the drought contributed to a shortage of safe drinking water.

Armed conflict: Since 1970s and 1980s, people in Boricha district have experienced a number of conflicts. They had armed conflict with the soldiers of the Derg's government in August 1980 because the local people opposed the imposition of farming and marketing cooperatives and confiscated resources (Vecchiato 1985). This is a fresh memory for the Sidama elders, which they refer to as the **Borrichchu urde** ('Boricha war'). Civil war in northern and eastern Ethiopia during the Derg's regime, as well as Ethio-Eritrean border conflicts in the late 1990s, impacted almost every household. Border conflicts between Sidama and non-Sidama ethnic groups over grazing land have been common for decades (Alan 2011:163).

Death of spouse/parents: Death during seasons of food shortage and disease outbreak impacted individuals and families in the Boricha. Informants identified the death of a spouse, especially that of a husband, which made life difficult for the rest of family members during a season of food shortage.

Food price escalation: This is a time when the prices for food items escalate and households cannot afford them, which reaches its peak in the drought season. Hikes in food prices occur when the global market prices for coffee increase and losses from drought and crop failure also increase.

Money shortage: The main source of cash income for local people is selling crops and livestock products. When there is drought and subsequent failure of these products, it affects not only food crops but also cash crops and other income sources, which leaves people with insufficient cash to meet household needs like school expenses and medical bills.

Alcoholism: Informants mentioned that during a year of good harvest, some men sell possessions and spend the money on drinking alcohol. Alcoholism makes people vulnerable to environmental risk. Informants

reported that people who drink often delay planting /farming and cannot catch up with rainfall variability. They may not be able to save resources and cannot afford agricultural inputs. Those people and their families are vulnerable to the outbreaks of malaria and diarrhea since they cannot afford timely medical expenses. Some people gave examples of individuals who received safety net resources from government and NGOs and spent it on drinking alcohol.

Adults' Knowledge and Skills that Enhance Survival During Difficult Times

The top two salient features of difficult times (food shortage and drought season) were used to examine the knowledge and skills that helped interviewees survive during these times. Table 3 identifies the 12 different types of knowledge and skills that helped local people survive during these two most difficult times.

Table 3. Adults' knowledge and skills that enhance survival during difficult times.

Knowledge	Σ of salience (N=70)	Composite salience (Σ/N)
Saving knowledge (<i>miinjira</i>)	50.86	0.73
Trading	23.55	0.34
Farming knowledge	22.65	0.32
Wage labor	12.49	0.18
Appropriate use of time (season)	8.22	0.12
Social network	7.20	0.10
Animal raising	7.13	0.10
Knowing time for selling & buying	5.67	0.12
Soil management	5.50	0.08
Harmony b/n spouses	4.64	0.07
Woodwork	4.45	0.06
No- alcoholism	1.84	0.03

Saving knowledge was by far the most salient item, but informants mentioned that other items such as trading, raising animals, knowledge of appropriate time to buy and sell products, harmony in the family and no-alcoholism that impact saving practices. On the other hand, the informants mentioned social networks, wage labor, and woodwork skills as alternative survival strategies when possessions (savings) are finished.

Descriptions of Knowledge and Skills that Enhance Survival

Saving knowledge: Saving knowledge refers to various abilities and behaviors related to saving resources. These include: knowledge/ability of how to delay immediate pleasure, consuming moderately even during the time of plenty, and knowing what type of resources (assets) are good for saving. The people call a person who knows how to save and reproduce resources **minjataamo** (for a male) or **minjataame** (for a female), which means a wise person who is future-oriented in his/her behavior. Minjataamo/me people who know how to save usually wait to sell produce for cash during harvest seasons, and consume moderate amounts of resources even during the season of good yield, thus saving more. While saving every type of resource is desirable, informants identify saving resources in the form of animals, their by-products (butter in this case), and weese as preferable to other crops that spoil. Thus Brøgger (1986:88) asserts, "All responsible Sidama are compelled to do a considerable amount of saving," and that converting resources into cash is quite meaningless to the Sidama. Learning to save and practicing saving seem to be more essential today than it used to be in the 1980s—due to climate change, droughts, and increased ecological uncertainties.

Trading knowledge: Some people in Boricha have skills to undertake informal trade with food crops and with cash crops in small markets. Informants said that this knowledge is very important to survive risky times since households who know and practice

supplementary businesses would be able to save crop produce for difficult times. As the environmental risks have become more prevalent, more people started learning how to undertake informal businesses. These days it is common to see people in Boricha villages bring consumption items such as flour, coffee, fruits and vegetables, sugarcane, and other commodities from the city markets or other villages and selling in their yards.

Farming knowledge: This includes knowledge of the farming season, skills of how to grow, and having experience of cultivating crops. As the delays of rainfall have become more common, understanding seasonal variation, i.e., change in production calendar, has been important knowledge that helps buffer risk or survive difficult times. Also, since the types of crops grown in different environments is changing, understanding the variations in and responding to the subsequent shifts in production seasons are essential to adapt to the risky environments.

Knowledge of opportunities in wage labor: This refers to knowledge of assessing job opportunities and skills of negotiating to obtain wage labor. When there is no other means to survive hunger during difficult seasons of the year, people with better knowledge of exploring opportunities and making use of those opportunities survive better than people without such knowledge. Major jobs include working on someone's farm for cash or food. Women may harvest weese for other women in exchange for food. Adult males and adolescents keep livestock and farm or weed lands for cash. If no adequate job opportunities exist in the villages, males travel to cities looking for daily labor. They can be gone for weeks at a time and return with money or food for their families. According to the informants, working for someone else for food used to be considered as **fokko** ('shame') as every farming household should have enough to sustain itself, but now due to climate change and land shortage, wage labor is a means of survival even during normal seasons for people with little or no land, and more people are leaving their villages for cities looking for jobs in different villages or cities.

Sometimes people offer 'unrequested labor' to better-off households in exchange for food if there is no paid work.

Knowledge/consciousness of seasonal changes: This is knowledge of anticipating seasons to come. Informants said that wise people could observe the state of crops on farms, the prices for food crops and animals in the market. They use this knowledge to save resources accordingly. This is important these days as new environmental risks mean that knowledge/behavior of the status quo may not help people to survive, and they need to adapt to changing practice of farming. As mentioned in the ecological description part of the paper, cropping patterns have changed--some crops were disappearing and new crops have been emerging as strategies to confront the shifts in production seasons.

Knowledge of building and maintaining social networks: This refers to the social capital that a household or an individual can have in the village, including good relationships with neighbors, networks for borrowing resources during the time of needs, kinship ties at different locations, and participation in different self-help groups. Informants indicated that people with knowledge of creating and maintaining larger social networks and kinship ties were more resilient during difficult times.

Pastoral knowledge: The knowledge and skills of raising livestock is central to a Sidama livelihood. People sell cattle for cash when they face financial emergencies. Cattle byproducts such as milk and butter are essential protein supplements to the carbohydrate-rich **waasa** (the harvested food from weese) (Quinlan et al. 2014). However, environmental changes and population pressures have limited the size and productivity of livestock and traditional knowledge and practices regarding animal production have been modified to respond to these changes. In the past, everyone knew animal protection strategies because it was easy to observe and acquire this knowledge and because every household knew how to do it. Currently, however,

raising animals is demanding because it is not undertaken in open pastoral spaces. People today raise a few cattle or sheep inside their house or tie them with poles in the yards of their house. They feed cows in their house or yard, and take care of their health like they do for humans. This was not the case before the 1990s.

Knowing when to sell and buy resources: For informants, this includes the knowledge of planning to sell or buy farm products and animals. They mentioned that a wise person is not in a hurry to sell crops during harvest time. Generally, people in Boricha encourage buying crops during harvest time and selling during hawado when prices go up.

Knowledge of soil fertility management: This refers to traditional ways of keeping soil fertile to increase yields. Hamer (1987:15) asserts that in order to sustain the subsistence of Sidama household, careful protection of soil is essential either through providing enough animal dung to ensure replenishment of soil nutrients, or by fallowing annually for larger gardens. This knowledge is more important now than it was in the past because of land degradation, soil fertility loss, and declined cattle production due to land fragmentation and climate change.

Knowing how to maintain harmony between spouses: Informants said couples needed to coordinate with each other in production and saving resources; working hard alone will not enhance resilience. Coordination between family members is important, particularly in managing cash crops like coffee, maize, and khat, and for taking care of livestock.

Wood-working knowledge: This refers to a variety of skills such as making and selling baskets from bamboo, house construction, making wood planks, and carpentry. These skills were limited to cities in the past, but are currently expanding in rural areas as more people in villages are learning and practicing them as an alternative strategy to survive ecological risks.

Knowledge of the hazards of alcoholism: (please see alcoholism under the descriptions of risk factors).

Adolescents' Knowledge of Ecological Risks and Coping Strategies

In the freelists, adolescents identified between two (low) and four (high) risk factors. A total of eight factors were mentioned, but Table 4 shows the top seven (armed conflict was mentioned by one adolescent and was dropped from the analysis). As Table 4 indicates, adolescents hold similar views as adults of the top risk factors although the level of salience varies. A slight difference existed between adults and adolescents with respect to the first salient risk factor; adults said the top risk factor was food shortage while the adolescents reported hawado as the top risk factor. In the follow up interviews, the adolescents reported that they considered hawado difficult to survive because it is the time of acute food shortage and it is not a good season for trading and wage labor; adolescents said **hawado duuchchuri maaxamanno** (during hawado, opportunities, including access to money, are hidden). Adults share this view but they tended to have a boarder perspective and explained that other factors also caused food shortages in other seasons—thus making food shortage the top of risk factor for adults.

Table 4. Adolescents' conceptions of risk factors.

Risk factors	Σ of Salience (N=50)	Composite salience (Σ/N)
Rainy season (hawado)	33.25	0.77
Drought	11.92	0.28
Alcoholism	3.08	0.07
Crop failure	1.25	0.03
Death of parents	1.00	0.02
Money shortage	0.75	0.02
Food price escalation	0.50	0.01

We analyzed dimensionality, and we compared adults' and adolescents' risk perceptions using a two-step

multivariate analysis. First, salient risk factors were examined using principal component analysis (PCA). We used the top 9 most salient risks for principal component analysis and submitted the presence of salient risks (1=mentioned, 0=not mentioned). Below we interpret the unrotated principle components as dimensions of perceived risk.

Salient risk factors loaded on three components in principal component analysis (Table 5). Food shortages (.62) and drought (.54) loaded on the first dimension (which we named "food risk"). This dimension is consistent with the qualitative interview results as informants reported that the season of drought is always followed by acute food shortages and scarcity of resources. The second component had two poles, which we named "safety risk-baashe", including armed conflicts (.47) and the deaths of spouses and/or parents (.44) at one pole; and hike in food price (-.43), money shortage (-.42), and baashe (-.36) at the other pole. While most causes of death in the Sidama community are attributed to health problems, occasional violent conflicts sometimes result in death. The third dimension included alcoholism (.82) and disease (.33). We named this "health and alcoholism".

Next, we used a bivariate regression analysis to compare the perceptions of salient risk factors between adults and adolescents. The salient risk factors loaded under the three components of the principal component analysis were referred to as "Food Risk" (FR), "Safety risk-Baashe" (SB) and "Health-Alcoholism" (HA) and used as dependent variables in a test to explore adult and adolescent risk perceptions. The perceptions of adults and adolescents do not match for Food Risk (component1): $b=2.40$, $t(117)=16.58$, $p<0.001$ indicating changes in risk perception between generations. This variation is consistent with the results in the salience analysis. As indicated elsewhere in the paper, the top salience risk factor for adolescents was the rainy season, which is associated with a food shortage, whereas the top risk factor for adults was food shortages that could occur in all seasons and that were caused by

Table 5. Dimension of salient risk factors.

Loadings of risk factors on components			
Variables	Food risk	Safety-Baashe	Health-Alcoholism
Food shortage	0.63		
Drought	0.54		
Baashe		-0.36	
Health risk			0.32
Armed conflict		0.47	
Death of spouse		0.44	
Hike in food prices		-0.43	
Money shortage		-0.41	
Alcoholism			0.82
Eigenvalue (% of variance)	2.02(22)	1.45(16)	1.07(12)

different situations including rainy season, yield loss and price hikes.

Adolescents did not mention baashe as a risk factor in their freelists. Regression results indicated that risk perception of adults and adolescents were similar in Safety risk-Baashe ($b=-0.01$, $t(117)=-0.05$, $p=0.962$) and Health-Alcoholism ($b=-0.01$, $t(117)=-0.03$, $p=0.976$) risk factors. The similarities suggest continuity of risk perceptions and imply that vertical and oblique modes of learning were likely common in the transmission of knowledge about risks. It also indicates that the term baashe as a Sidama cultural model could be a sense that does not develop until middle-aged adulthood, since adolescents still perceive money shortages and food hikes (important parts of baashe); however, they do not use the term baashe. This suggests that additional qualitative work regarding when individuals do acquire the content of

baashe could be a fruitful avenue for further research. Similarly, we must ask why adolescents perceive significantly less Food Risk than do adults. Perhaps recent memory of the devastating famines of the 1970's and 80's is fading.

For the question 'What knowledge and skills enhance survival during difficult times?' adolescents identified between one (low) and five (high) survival strategies, and a total of ten knowledge items were identified (Table 6). Saving knowledge was the most salient factor for both adults and adolescents. Adolescents also identified two related items that adults did not mention: keeping family size small and sharecropping. They identified land shortage as a persistent problem that was caused by population pressure. Sharecropping, which is working for people who have large tracks of land and sharing the products, is an option available for some wise and hardworking individuals to survive difficult times.

Table 6. Adolescents' knowledge and skills that enhance survival during difficult times.

Knowledge	Σ of Salience (N=50)	Composite salience (Σ/N)
Saving	30.85	0.72
Trading	15.63	0.36
Hard working	6.89	0.16
Time to buying products	5.78	0.13
Wage labor	3.32	0.08
Farming knowledge	1.33	0.03
Wood work	0.75	0.02
Pastoral knowledge	0.60	0.01
Small family size	0.67	0.02
Sharecropping	0.50	0.01

From Whom Do Adolescents Learn?

Adolescents identified different sources from which they learn knowledge and skills that are important to survive the two salient ecological risks from the adults' freelists. Parents were identified as the primary transmitters of essential survival knowledge

and skills. However, one-way analysis of variance (ANOVA) shows no statistically significant difference between the sources. Table 7 shows the proportion of adolescents acquiring knowledge from different sources. The relative importance of knowledge sources varies by the gender of the adolescents. The difference between male and female adolescents was statistically significant for the source of saving knowledge ($\chi^2 (6) = 17.5815, p = 0.007$), and farming knowledge ($\chi^2 (5) = 19.9264, p < 0.001$).

It is worth mentioning that both parents were equally important sources of saving knowledge; some adolescents were unable to differentiate the role of mother and father for each item asked. They said, "My mother and father told me this; I heard both my mother and father talking". Parents use different techniques and expressions to inculcate adolescents with the value of saving. Adolescents also mentioned that parents advised them not to trust the future. For example, through statements such as "you do not know what will happen tomorrow", and through encouraging adolescents to be conscious about unexpected changes, to work hard, and to learn to save what they have now. Parents also used local sayings that inspire adolescents to learn to save in the present time. For instance, a male adolescent reported that his mother used local proverbs, saying, "**minjiirinohu gedenssasi diba'anno**", which means 'a person who knows how to save will have a better future'. The group 'parents and other adults' was also mentioned as an important source of children's knowledge.

Considerable proportions of adolescents of both sexes mentioned that they learned about animal protection, farming season, and appropriate times to sell farm products and animals by listening to group discussions between parents and other adults during coffee hours called **bunu waare**. It is a gathering of males and females that takes place almost every day, when adults and adolescents from the immediate neighborhood come and sit together within an arm's reach of each other, discussing skills or different topics of interest. People in a neighborhood gather for

Table 7. From whom adolescents learned survival knowledge and skills.

Knowledge	Knowledge source (percent N=50)				
	Parents	Peers	Other adults	Personal observation	Doesn't know
Saving	74	0	6	8	12
Trading	12	20	12	4	52
Farming	67	0	9	0	24
Soil management	64	0	0	6	30
Pastoral	49	0	3	0	48
Time to sell and buy resources	66	0	0	21	13
Woodwork	7	0	7	0	86

coffee at least two times in a day. There are morning coffee hours between 8 am and 9 am, afternoon coffee hours between 1 pm and 3 pm, and evening hours between 8 pm and 10 pm. Few houses gather for evening hours. Gatherings consist primarily of neighbors, but the Sidama neighborhood mostly consists of patrilineal kin groups such as members of extended family, cousins, or otherwise related by blood. Self-reports indicate different modes of learning are associated with different knowledge and skills. An analysis of the validity of self-reports is important but beyond the scope of this paper.

How Do Adolescents Learn Survival Knowledge and Skills?

Adolescents learned saving and other survival strategies through diverse processes including verbal advice, listening, observation, participation in adults' activities, or through various combinations of these processes. The adolescents were asked how they learned the three top types of survival knowledge in the adults' freelists: saving knowledge, trading knowledge and farming knowledge (farming season and farming skills). Results indicated the importance of learning processes varies along with the types of knowledge and skills. From the 50 adolescents interviewed, 48 percent of male and 43 percent of female adolescents reported that teaching was an important process to learn saving knowledge. Teaching in this

analysis was defined as modifying behavior to help another learn.

Sidama adults and adolescents conceive of teaching in various forms. **Seejjo** ('an intentional verbal advice') refers to advising adolescents about acceptable knowledge, values, and ways of life, such as how to save resources and delay immediate return. The other one is called **rosiisa** (involving verbal instruction and demonstration of activities), which is a process targeted to teach or train a particular skill and/or knowledge to the novice. Both seejjo and rosiisa involve follow-up and feedback from parents or other transmitters. **Kula**, on the other hand, refers to providing a piece of information either intentionally at a child's request, or when parents plan on (or are interested in) passing on certain knowledge to their children.

Listening was another process by which adolescents (35 percent male, 33 female) reported that they acquired saving knowledge. Listening in Boricha context takes place at various venues, ranging from adolescents listening to parents' discussion at home to listening to a group of multi-aged individuals during various occasions. During the fieldwork, the first author participated in several coffee hours with 10-15 people, where both male and female adults and children come together and talk about food prices, farming seasons, the importance of some type of crops over another in helping survival during difficult times, and "good" and "bad" behaviors.

Twenty-four percent of male and female adolescents reported that they learned trading knowledge through observing experienced individuals. Additionally, seven percent of male adolescents and 10 percent of females said they learned through working with experienced persons. Ten percent of male adolescents and seven percent of female adolescents learned trading knowledge by listening to adults and experienced adolescents. A considerable proportion of interviewed adolescents (57 percent male, 62 percent female) did not have trading knowledge.

Learning by participation in adults' activities (doing together) was reported as an important process for acquiring farming knowledge—comprising 45 percent of male adolescents and 14 percent of female adolescents. When adolescents participate in the activities of the experienced persons, they could acquire knowledge and skills with a minimum or no verbal communications with transmitters. Similarly, 21 percent of male adolescents and 24 percent of female adolescents reported that they learned farming through observation, whereas 24 percent of male adolescents learned it by teaching (rosiisa).

DISCUSSION AND CONCLUSION

Food shortage and drought were salient ecological risk factors for adults and adolescents of Boricha districts. Both are underlying causes of other risk factors such as disease (malnutrition and malaria), loss of loved ones, death of animals, crop failure, and hikes in food prices. All of these are difficult situations to survive for subsistence producers of Boricha district. A diverse and complex set of knowledge and skills enhances the Sidama's abilities to survive substantial ecological variability.

Saving resources, knowing appropriate times to sell and buy produce, thinking for 'tomorrow', anticipating the future, and utilizing resources in moderation were identified as knowledge or skills essential to survival during difficult times. The importance of a cultural model of saving as a survival strategy has seldom been noted in previous studies

of small-scale societies. Previous studies of coping strategies in small-scale societies identify an array of other factors: risk forecasting and seasonal mobility, (Leslie and McCabe 2013; Gomez-Baggethun et al. 2012) outward migration (Deshingkar 2012), flexibility in subsistence strategies and livelihood diversifications (Berkes and Jolly 2001; Minter 2010), cooperation and exchange with other relatives and friends (Lye 2013), and reorganization of social groups (Fratkin 1986). The Sidama's cultural model of saving is consistent with Woodburn's (1982) 'delayed-return system' (or what economists call 'time preference', Godoy et al. 2005) that emphasizes waiting to obtain a return on investment. This contrasts with 'immediate-return systems' that contribute to rapid consumption and discourages the accumulation of supplies and property.

The study also found a slight difference in perception of risk between adolescents and adults. High risks for adults included food shortage caused by **moolle** ('drought season'), high food prices, seasonal food shortage, and related factors, whereas adolescents said that hawado (a rainy season prior to harvest time) was the most difficult time to survive. However, adolescents and adults stated the same reason for difficult times--food insecurity. Adults focus on underlying causes, whereas adolescents tend to see immediate problems (perhaps because of the limited life experiences). According to adult informants, acute food shortage in hawado always follows a drought year. Adolescents' responses, however, are consistent with adults' ideas about hawado time; limited food supply exists as do money shortages, as it is neither harvest time nor trade time. Hawado in Sidama in general represents shortages of resources.

Adolescents and adults have similar notions of knowledge about saving as an essential feature of survival during environmental shocks. Both adults and adolescents said minjataamo/me (a person who saves resources and reproduces assets during normal production years) would easily cope with unexpected adversities. This is a widely shared value and cultural model.

Observation and informal interviews revealed that adolescents starting from the age of 10 know about saving and other knowledge and skills important for resilience. This supports Hamer's assertion that among the Sidama, training of children for important values begins at the age of six (Hamer 1987:44). A vertical mode of knowledge transmission is the dominant learning mechanism for saving knowledge and other necessary skills followed by a 'vertical-oblique' combination. This finding is consistent with previous studies in small-scale societies by Hewlett et al. (2011), Reyes-García et al. (2009), Eyssartier et al. (2008) and Hewlett and Cavalli-Sforza (1986). These studies found parents and other adults are important transmitters of skills and knowledge to adolescents, but also that many other people contribute.

The findings of this study also confirm the ethnographic work of Hamer (1996) among the Sidama. Fathers instruct sons in the productive work adults, teaching them to herd the household's cattle and later on how to prepare and care for gardens. However, current findings deviate from Hamer's assertion that boys learn from their fathers while mothers are responsible for teaching their daughters; results in this study suggest that males and females equally learn about saving and other knowledge from both parents. The variation may be due to the fact that in comparison to Hamer, our study was much more systematic and involved interviews with adolescents. The other possible explanations of the deviation are recent changes in Sidama ecology, their socio-economic system, and their gender roles. Further study is needed to fully elucidate this.

The 'vertical-oblique' mixture is also an important avenue through which adolescents learn important knowledge such as saving and appropriate recourse management. This form of cultural transmission has not gained close attention in previous studies of social learning. Hamer's work, however, implies the existence of 'vertical-oblique' mix as an important source of children's knowledge among the Sidama.

According to Hamer (1987:46), sons observe their fathers and other men in the community as they plan a balance between subsistence and cash crops so as to maximize profits from the sale of coffee without exhausting their food supply. Our findings from coffee hour observations are also consistent for the case of girls and women, since adolescent girls have a chance to learn important knowledge by listening to their mothers and other women during these gatherings.

This study reveals various learning processes through which Sidama adolescents learn and acquire saving knowledge and other important skills. Teaching followed by listening are both important for learning survival knowledge from different sources. The evidence of the presence of teaching among Sidama farmers in the forms of seejjo and rosiisa coincides with the evolutionary anthropology and developmental psychology propositions that explain teaching is a part of human nature, and exists in small-scale societies (Gergely and Csibra 2006; Hewlett et al. 2011). Our findings about the existence of teaching as an important source of knowledge among the Sidama also confirms Hamer's assertion: "boys are taught that the means to wealth is through planning, persistence, and the use of knowledge" (1987:46). Observation accompanied by listening improves adolescents' knowledge. This is also partly consistent with the findings of Tucker (2007) research among the Mikea of Madagascar, which demonstrated that observation and memory recall improve the knowledge about covariation of livelihood activities with rainfall that individuals acquired through listening to ethnotheory (local explanations to patterns of variations in rainfall).

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